



Writing Samples & References

Wayne Labs



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Embedded Linux: Maybe yes, maybe no, but definitely worth a look-see

Wayne Labs
Senior Technical Editor

While Linux may not be 100% ready to host all your desktop activities, the embedded versions—real-time and nonreal-time—are being quietly put to the test by developers, and may be ready to run your control application. True, compared with Windows CE implementations, embedding Linux may require more work up front if you roll your own, but if you're making thousands of devices, zero licensing costs can look attractive.

Commercial embeddable Linux products are another option. Says Rick Lehrbaum, executive editor of LinuxDevices.com, most vendors of embedded Linux need to charge up front for software developer kits (SDKs)/seats and/or annual subscriptions, since they generally don't have royalty income. Microsoft, on the other hand, keeps SDK prices low, and prefers income from royalties.

According to data recently compiled by Evans Data Corp. (EDC, Santa Cruz, CA), Linux and Windows OSs are running neck and neck in terms of developer use for future projects. The newest installment of EDC's *Embedded Systems Developer Survey*, fielded in July, 2002, shows 30% of embedded developers (444 participated in this survey) expect to use Linux in their next embedded project, while 16.2% say they will use Windows CE and another 14.4% say they will use Windows XP Embedded—giving Windows Embedded OSs a slight edge over Embedded Linux, at 30.6% vs 30.2%. Embedded Linux, however, has double the

growth rate—although relatively small in market value. You can find more details on this study at www.linuxdevices.com, or by contacting EDC at 800.831.3080 or www.evansdata.com.

According to a Venture Development Corp. study, *The Embedded Software Strategic Market Intelligence Program 2001/2002 Volume VI: Linux's Future in the Embedded Systems Market*, factors slowing the adoption of embedded Linux include real-time limitations, doubts about availability and support, fragmentation concerns, doubts about vendor longevity, and footprint size.

I thought it would be interesting to get some feedback from someone who has taken the embedded Linux plunge. Steve Schoenberg, president of Sixnet, got some first-hand experience in the development of his company's SixTRAK IPm Open DCS controller (www.sixnetio.com). The device runs embedded Linux and supports five Ethernet and three serial ports. Explains Schoenberg, "We need to be able to accurately control character timing for PLC protocols such as Modbus RTU. We need to support party-line handshaking for radios and RS485 networks. CE does not support these features. In all candor, Linux didn't support these features either. The difference is that with Linux we had the source code and could improve the drivers. Moreover, we could submit the code for inclusion in the next release of the Linux kernel, making it a standard product feature in the future."

What about development costs and support? Schoenberg replied, "In addition to the direct development cost savings, we have benefited greatly from the sharing of public code. It is as if we have a hundred developers working for us. There are features along the way we needed that, through postings on the Internet, brought us code from other developers."

Who is buying IPm? Said Schoenberg: "Users fall into several categories. Some just love the many features and the high performance. These customers also love the open concept. It gives them security. We have OEMs who are enhancing their product and making it their own. USFilter Controls has announced its new RTU, which adds features to our RTU. We also have third-party vendors writing their own applications—to turn our IPm into their own product, or to sell as add-on applications. We have integrators enhancing their applications' capabilities with our C compiler. The spectrum is complete from *leave it alone* to *take it apart*."

Is embedded Linux right for you? It's worth a look-see.



{control software
upload/download}

Linux in Control gets in control with first meeting in Leuven, Belgium

Wayne Labs
Senior Technical Editor

Organized by Herman Bruyninckx (Katholieke Universiteit Leuven), Nicholas McGuire (RTLinux/GPL), and Peter Wurmsdobler (Real-Time Linux Foundation and Eurotherm Drives), the first Linux in Control Workshop came together at Leuven, Belgium on 9-10 May 2003. Representatives from more than fifteen Free Software projects in the area of control met to get to know each other's project goals and current development status, and to foster an open discussion of how projects can cluster to define and reach common goals.

Ongoing projects include a broad range of control-oriented infrastructure and tools, from real-time operating systems RTLinux and RTAI, to device driver projects such as COMEDI, CanFestival, and RTnet, to control projects for PLC, machine tools and robotics, to HMI projects. Just what you'd expect if the Linux platform is to become viable for control.

I asked Peter Wurmsdobler, who is now stationed in England, if the meeting was, in his opinion, successful. "There were more than 45 participants, mostly from European countries," he explained, "but also a few from the Americas and even somebody from Australia. I think people realized that there is more to industrial control and automation than any individual project on which they are focusing. They started to raise their heads from

their own project and look to their neighbors' projects. So developers could convince themselves that while there are some efforts going on unnecessarily in parallel, many projects are complementary. They became aware that some projects tied together may offer the major components for building a complete 'Linux in Control' solution. Certainly, some work and co-operation is required, but it is feasible, and all participants committed to contribute to the development of a general framework. Working groups will address several areas such as real-time issues, middleware and network infrastructure, or graphical interfaces."

I commented to Wurmsdobler that many of the Linux real-time control efforts are fairly invisible to the manufacturing/industrial community, and asked him why these projects seem to be shrouded in secrecy. I also inquired as to the audience the group is targeting for future involvement. Was he looking to attract end users, SIs, commercial developers, or a combination of all three? He replied, "Indeed, there are many Linux-based products already on the market; unfortunately, in some cases they're hidden, and in many cases not announced with bells and whistles. It is not transparent to me what the exact reason behind this is. Maybe if a company announces that its product is Linux-based, it is afraid that its competitors might now understand the product's architecture. If it were based upon a proprietary operating system, nobody could tell how the system works. Maybe it's also a lack of legitimacy and that Linux-based products might be perceived as academic or unprofessional. The problem is, GNU/Linux-based control projects as a whole need more visibility to build up that legitimacy. The mythical belief that proprietary software is professional, and free software is not, needs to be left behind. How can this be achieved?"

Wurmsdobler answered his own question, "To start with, more information on GNU/Linux needs to be published, explaining new terms such as 'free software,' and how business can be done. This goes beyond the technical level. I hope that the Linux in Control Web site will be able to provide such information soon. On the technical side, it is necessary to tell companies that a lot of free software elements are available on the Internet to build control solutions, and that there are already running Linux-based control systems. Our new Web site, www.linuxincontrol.org, should provide all that information soon.

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“On the question of the target group, in my opinion, control system integrators must be reached. They are most appropriate in adding value to free software in the control arena. They can take and even contribute to free software projects, especially as far as interfaces and protocols are concerned, and build solutions around them. They would be situated between the free software components builders and the end users.”

Of course, there are different ways of accomplishing real-time under Linux. But are there approaches to solidifying these, or to making it easier for engineers to choose an approach? (After all, Windows offers a common API, and the proprietary RTOSs offer all sorts of development systems...with GUIs.)

Wurmsdobler: “To be correct, neither GNU/Linux nor Microsoft Windows OSs are real-time operating systems. Both are general purpose OSs, and for both, some add-on is required to achieve real-time performance. The good point about GNU/Linux is that both the OS and real-time extensions are available as free software, and the system interfaces are vendor independent.

“GNU/Linux is heading towards the Single UNIX Specification, which integrates the POSIX standard. In addition, the real-time extensions RTAI and RTLinux both offer a POSIX compliant programming interface; in more detail, RTLinux implements the POSIX 1003.13 profiles 51 through 54. Hence, there is a common API that real-time Linux variants converge to or implement already, and it’s up to the user to choose the implementation most appropriate for the application. However, in no case would a user of real-time Linux or GNU/Linux be locked into a particular operating system implementation.”

I asked Peter whether we will see a Linux PLC any time soon. He responded, “To my knowledge, there are already some Linux-based, but proprietary, PLCs working in CNC machines, and also PLC run-time environments running on Linux. But the question here is whether a complete PLC solution based on Linux is available soon, including a real-time, run-time system and a programming environment. Well, the matPLC project is a candidate for becoming such a Linux PLC. As a result of the workshop, it has been decided that local I/O will be worked into matPLC by making use of the COMEDI project. An IEC-61131-3 ST editor and compiler is on its way, and a ladder diagram editor and a sequential function block editor will be integrated, too. It would now require a major end-user or SI to guide and promote the project, but still maintaining it as an open source project.”

I asked whether Linux in control might steal away applications from proprietary RTOS suppliers and Microsoft Win CE.

“GNU/Linux will steal from both. From the first, because GNU/Linux is available for many processors, and lots of free software is developed for COTS hardware, such as Ethernet adaptors

or DAQ boards. As the hardware evolution is very fast, many RTOS vendors cannot keep up with the development speed in providing drivers or common system components such as network stacks, but all GNU/Linux developers together can. From the second, because Windows, despite its common API, remains a highly proprietary OS users are locked into, has a big footprint, requires a lot of CPU resources, and will only be available for Intel processors in the future (as far as I am told), etc. Generally speaking, I believe that OSs and other system software such as web servers will become convenience components in software in the future, and GNU/Linux provides all that now in a fine grained manner. This also means that no money will be made with OSs and systems software, but that value creation moves up to higher levels.”

I asked Peter what is the future of Linux in Control? He noted, “During the workshop it had to be pointed out that the GNU/Linux is not the solution as such, but it offers free software components required for building a control solution. It was also understood that a framework has to be developed, with infrastructure software, which then allows companies to take it on and build real solutions for real problems. It must even be possible to incorporate proprietary components in such a framework, protecting intellectual property. Companies employing GNU/Linux and the infrastructure would eventually feed back software where it makes sense, where its use is general and not specific to the value the company adds. For instance, it does not make sense to implement device drivers several times, protocol stacks, or PLC run times in different companies. These pieces of code can be shared. If one thinks a control system to be cut into reasonable chunks of components, GNU/Linux can provide many of the common components as it implements open, vendor-independent interfaces. In this sense, GNU/Linux is also the great facilitator of open control systems. Here again, value creation moves up a level higher, to system integration with common software components being freely available, shared and for free.”

Wurmsdobler summed, “It has to be emphasized that the question is not only about an OS, GNU/Linux, but also a new paradigm of seeing software development—the free software concept. Free software doesn’t imply zero cost of ownership, nor does it mean that a provider of free or even derived software can’t charge for the service or improvements provided. Instead, the phrase means that anyone is free to use, run, share, copy, distribute, study, change, and improve the software. Open source code is the logical consequence of the freedom that is guaranteed by a general public license (GPL). As a second consequence, no license fees have to be paid for free software. This should mainly apply to the common system components in an open control system, all the general pieces of software which can be shared easily.” ■■■

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{special report}

Because of ongoing innovative enhancements to this technology, whatever you need you can find. Better still, you can either buy the tools or, in some cases, build them yourself.

HMI: The hardware and software of it

Wayne Labs, Senior Technical Editor

When it comes to human-machine interface (HMI) technology, your



Spectrum Controls' SOI-260 is available in an intrinsically-safe model for explosive atmospheres.

options are wide open. You can buy HMI hardware in most any form factor you want, and you can build or buy incredibly versatile HMI software for next to nothing (check out <http://pvbrowser.org>) or, at the very least, for a very reasonable price. As ARC Advisory Group (Dedham, MA; <http://www.arcweb.com>) points out in a recent study, the “pure play HMI software market remains saturated as HMI applications approach commodity status.” Translation to users: The price is right!

At the hardware level, there's something for everyone—from handheld wireless devices to machine-mountable Windows CE or embedded OS-based devices to flat-panel touch screens and large computer-based HMIs. While flat-panel screens are just beginning to take hold in the consumer market, they've already gained a lot of ground on the plant floor. Reason: They take up a lot less space than CRTs, are easy to build protective cabinetry around, and are immune to electrostatic and electromagnetic fields.

In this article, we'll look at some of the newest HMI hardware and software technologies available for industrial and process applications.

Smaller hardware for tight spaces

An HMI for a PLC doesn't have to be large and complicated. A small, character-based device often can fill the bill quite nicely. Take, for example, Spectrum Controls' SOI-260, which works with most major PLCs and provides communications for ODVA's DeviceNet, Modbus, Simatic S5, Square D SY/MAX, IDEC's FA Series, Omron's Hostlink, and TT's 405. The SOI-260 is also available in an intrinsically-safe model for use in explosive environments. This HMI provides menu screens that can be linked to provide a complete set of instructions for the operator to follow. It also supports point/access display, which



Red Lion Controls' G303 offers up to five serial comm ports, has built-in Ethernet, and fits into panel cutouts of 6.04 x 4.44 inches.

allows access to the entire data register table within a PLC for debugging and troubleshooting. The SOI-260LC has a 4 line x 20 character LCD with LED backlit display and a 10:1 contrast ratio. Also available is the SOI-260VF with a vacuum fluorescent display.

For those of you who need a small HMI device, hardware such as Red Lion Controls' G303 may provide the solution. These HMIs come in a panel size of 7.45 x 5.85 in. (panel cutout 6.04 x 4.44 in.). The G3 hardware platform used with built-in Crimson configuration software features ease of use, along with varied communication and computational capabilities. The G303 provides up to five serial communication ports that can be configured to communicate (at speeds up to 115 kbaud) with an extensive list of devices, including most PLCs, motion controllers, and PID controllers. It has an integrated protocol converter that provides an easy way for these devices to have integrated communication. The unit comes standard with a 10/100Base-T Ethernet port, which can be used for remote communication and web diagnostics.

Maple Systems' HMI 500 Series features panel sizes that run from 5.7 in. up to 10.4 in., with prices ranging from \$550 to \$1850, depending on size and display types. As with Red Lion, the news is in the unit's software, or often in what the HMI supports. Maple has added to its list support for Keyence's KV Series, Control Technology Corp.'s (CTC) 2200-2800 Series, Yaskawa, Siemens TI505, and more support for Allen-Bradley and CompuMotor. Updates have been made to the Allen-Bradley DF1 ControlLogix and SLC500 protocols to include floating point register support, and the CompuMotor protocol has been updated.

QSI Corp.'s QTERM-G75 is an Ethernet-enabled graphics terminal that fea-

tures a 640x480 10.4 in. color LCD, 10 Mbit/s Ethernet, touch screen with optional PS/2 keyboard connection, NEMA-4 CE-certified aluminum housing, 16 Mbytes RAM, 2 Mbytes Flash, and RS-232, -422, and -485 interfaces.

What do you get when you cross a Beckhoff Control Panel and a PC? A Panel PC. The company's entire line of aluminum-constructed Control Panel LCD monitors, which range from 6.5 to 20 in., are offered with four types of integrated PCs to create various Panel PCs. The vari-

ations available offer customers the flexibility to meet specific requirements at the right price. The Control Panel, which makes up the HMI, has options for a full membrane keyboard, function keys, keyboard ports, disk drives, mouse ports, built-in electrical push buttons, touch screen, touch pads, and customer specific data ports such as data card readers. The PCs are scalable in size and functionality from the miniature CX1000 up to the full size ATX motherboard CP6500. The CX1000 can be used as an all-in-one



Schneider Electric's new Telemecanique® Magelis XBT-G touch screen HMI terminals come in a variety of sizes (5, 7, 10, and 12 in.). They feature a compact footprint and Ethernet connectivity. See p 54 for more on this family of HMIs.

Covering All Bases



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Beckhoff's Panel PCs integrate LCD monitors from 6.5 to 20 in. with PCs.

motion, PLC, and HMI controller running Windows CE or Windows embedded XP. The CP6300 Panel PC has a single-board computer capable of operating a PIII 850 MHz Intel processor with one available ISA/PCI slot, 128MB upgradeable SDRAM, and onboard Ethernet. The CP6400 has all the capabilities of the CP6300, but with more available slots. Finally, the CP6500 has a full size socket 370 ATX motherboard that has the most available slots and an option for a socket 478 motherboard.

Another panel-mounted PC option is Axiom's Panel 1000-370. The 10.4 in., 250 nit 640x480 screen has a NEMA 4/12-rated front bezel and a resistive touch screen. You can opt for an Intel Celeron or Pentium III processor, and the computer features an Ethernet port, parallel port, VGA port, and COMM ports. It operates in temperatures from 0 to 40°C and in humidities of 5-95% noncondensing.

Windows CE-based HMIs

If you need a panel that can withstand outdoor use, Exor's UniOP eSOPx39 and

eTOPx39 displays use a new technology display that works in sunlight without requiring exceedingly bright backlighting. The 10.4 in. advanced Transflective display features VGA resolution, NFI touch screen, an operating temperature range from -10 to 55°C, connection to industrial bus systems and Ethernet, and availability with Windows CE or Linux.

Earlier this year, Rockwell expanded its Allen-Bradley® VersaView™ industrial computer line with the new VersaView CE™ industrial computer, combining the



Exor's UniOp panel displays work outdoors in bright sunlight without needing hefty amounts of backlighting.

{special report}

Microsoft Windows CE platform with rugged hardware designed specifically for industrial applications. The computer is an open platform computing solution suited to HMI, customized applications, information management, and remote terminal applications in situations where users need the flexibility to customize or use third-party software programs, but don't necessarily want the full functionality of an industrial computer. VersaView CE uses an Intel Celeron 650 MHz processor and 256 MB of both flash and RAM memory, and is available with 6.5-, 10.4-12.1- or 15-inch TFT active matrix color displays with multiple keypad and touch screen options.

Another Windows CE option is Nematron's PowerView/CE .NET-based HMIs. These HMIs include Nematron's OpenView Machine Edition/XE program-



Rockwell's VersaView CE computers come preloaded with RSView Machine Edition runtime, and can support terminal services for thin-client operation.

ming software, which is sold separately. Three workstations are available in the Series: 5.7 in. STN, 4096 colors, 320x240 resolution; 7.7 in. STN, 4096 colors, 640 x 480; and 12.1 in. TFT, 4096 colors, 800x600 resolution. All units feature 32 M DRAM and 16 M Flash memory, compact Flash expansion slot, Ethernet, real-time clock, 16-bit sound, 24 Vdc operation,

and NEMA 4/12 and IP65 ratings when properly mounted.

Yet another Windows CE .NET option is also a wired or wireless handheld computer. Designed for one-handed operation, the JETT•ce, from Two Technologies, features a Windows CE .NET 4.2 operating system, Intel® XScale™ Technology processor, sunlight readable dis-

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Circle 12 on Control Solutions International RS Card

{special report}

play with touch screen, and a variety of interface capabilities. The JETT•ce works in a wide range of applications.

The standard 320x240 pixel QVGA-TFT color display is sunlight readable with an LED backlight for easy viewing in high- or low-light conditions. The touch screen gives you the ability to create GUI based applications—providing unlimited possibilities for user control.

The JETT•ce comes standard with 64MB of SDRAM and 64MB of built in Compact Flash (approximately 16MB used for OS), which is expandable to 128MB. For removable data storage or I/O cards, the unit is equipped with a Compact Flash (CF) slot. Featuring a variety of interface options, the JETT•ce comes standard with one RS-232 serial port. For applications that require dual serial port capability, a second serial port configured as RS-232, RS-422 or RS-485 is available.

HMIs with software

Eaton Corporation released the latest addition to its PanelMate® ePro family. The Cutler-Hammer PanelMate ePro XE com-



Nematron's OpenView Machine Edition/CE programming software for PowerView/CE HMIs.

binates the flexibility of a PC-based SCADA system and the reliability of a dedicated HMI product. This latest development builds on the existing ePro OI foundation by adding recipe/machine setup functionality, data trending, document viewing/browsing, and data historian capabilities. Designed for harsh environments typical to industrial applications, the ePro XE uses solid-state memory technology



Two Technologies' JETT•ce handheld HMI runs on batteries or external power, and can be used as a wireless HMI.

that is resistant to vibration and temperature extremes. Consistent with all PanelMate ePro models, the ePro XE has built-in 10/100 Mbps Base-T Ethernet. Users can share files and data between PLC and business systems, and perform quick and easy file uploads and downloads to PanelMate ePro units. Additionally, it features an expansion slot for optional proprietary network interface cards that support existing and new installations.

If you're in the market for larger touchscreen HMIs, IDEC has added two models to its HG family of HMIs. The HG3F and HG4F HMIs are full 256-color touch screens with TFT LCD screens and replaceable backlights. These new larger screens are RS-232, RS-485 or RS-422 compatible, with Ethernet and Compact Flash support. They are CE-marked, c-UL and UL Listed, meeting UL 1604 for hazardous locations and IP65 standards. The HG3F has a 10.4 in. screen, with a display of 640 x 480 pixels. The HG4F has a 12.1 screen with a display of 800 x 600 pixels. Both models weigh 6.61 lbs, and have di-

mensions of 13.7 x 10.6 x 2.8 inches. The touch screens work with all of IDEC's programmable logic controllers, and have drivers available to make them compatible with PLCs from other manufacturers. Each series also has a dedicated programming software package to suit the particular features of that interface.

Advantech's FPM-3120 and FPM-3150 TFT LCD flat panel monitors come equipped with 300 nits and 350 nits of brightness, respectively, and a rugged capacitive touch screen. The capacitive touch screen is highly suited for environments requiring sturdy, robust performance, such as industrial and vending deployments. The FPM-3120 and 3150 are equipped with direct VGA signal transmission to allow data viewing up to 160 feet away. A regular VGA control card may be used on either system, and users can upgrade the display without making changes to the existing system. On-screen display allows users to adjust images on the screen with ease. Both monitors are designed with an industrial applications in mind. The FPM-3120 is specifically designed for applications with limited installation space. The backside cut-out dimensions are the same as traditional 10 in. displays. With a new magnesium panel, mounting is easy and fits most environments perfectly. The entire chassis is stainless steel, and the front offers NEMA4/IP65. Also suited for industrial applications, the FPM-3150 offers a stainless steel chassis and a NEMA4/IP65 compliant aluminum front panel.

If you need a touch screen monitor for demanding industrial applications, 3M's MicroTouch™ ChassisTouch™ 450 FPD has National Electronic Manufacturers Association (NEMA) 4X and



Eaton's PanelMate ePro XE is offered with color DSTN and color TFT displays.



IDEC's HG3F and HG4F are 256 color TFT LCD screens with 10.4 and 12.1 in. screens (respectively).

Ingress Protection (IP) 66 ratings, meets 3M's shock and vibration specifications (20G, 11 ms pulse; 5-2000 Hz, 2G), and offers Near Field Imaging projected capacitive touch technology. Ideally suited for harsh environments, the 450 product can withstand high-pressure wash downs common in manufacturing environments, and the touch screen is unaffected by most surface contaminants found in factories, automation environments, utilities and mining applications. The 15-in. monitor displays 16.7 million colors at 1280x1024 and operates in temperatures from 0 to 50°C.



3M Touch Systems' Model 450 survives the shock and vibration of harsh industrial environments.

If you're looking for an industrial-strength HMI you can mount on an arm, consider Industrial Electronic Device's ARM-15 and ARM-15T models. Their rugged 14 gauge steel chassis are designed to take the daily abuse and dusty dirty environments. The front bezel is finished with a non glare flat black while the case is a semi gloss for easy

cleaning. The display has a 450 nit brightness rating and is capable of picture-in-picture support for camera inputs. The touch screen display has a splash-proof front and a plug-and-play VGA interface.

Contec's heavy duty DT20 Series of flat panel displays features analog resistive touch screens and long-life backlights that add to their suitability for use



Advantech's FPM Series offers NEMA4/IP65 ratings and bright screens.

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INNOVATION IN INTERFACE

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in harsh environments. Compact and lightweight, these displays all measure less than 2 in. deep, permitting them to be mounted in the tightest of settings. NEMA 4/12 (IP65) protected front panels are designed for use in the most rugged of applications.

Another option for harsh environments, and FM approved for hazardous areas, is Daisy Data's standard flat panel display series (4500KP and 2500KP), which now include a legendable membrane keypad. Flat panel displays are available in 12.1, 15, 18.1, and 20.1 in. sizes. Customers can choose to have a PC integrated into the enclosure, or they can order it with a Cat5 or Fiber Optic KVM extender to provide connection to a PC at up to 400 ft (copper) or 1000 m 9fiber optic). Enclosures are available in NEMA 4/12 (painted CRS) and 4X (SS).

What about explosive atmospheres? Christensen Display Products has announced a major extension to its family of industrial flat panel monitors. Dubbed the -HZ series, most monitor configurations from 10 to 20 in. are now available listed and labeled for Class 1 Div. 2 Hazardous Location use. Customers can use these devices without cumbersome and expensive purge control systems. The line extension includes over 35 new part numbers. Both touch screen and standard versions of 10, 12, 14, 15, 18, and 20 in. monitors are included.

Dolch's SafeTTouch EX is a flame-proof, explosion-proof touch screen workstation. Certified for use in Class I, Div. I—Group D hazardous environments, the FPD computer does not require a costly, troublesome air purge system. It is constructed of case aluminum and uses Dolch's "EnhancedInfrared" touch screen technology to create a dynamic and durable interface suitable for use in extreme environments.

Go wireless

For applications where wired isn't a possibility, check out Comark's RF 802.11B



Daisy Data's standard flat panel display series now offers a legendable keypad. It's also FM approved for hazardous environments.

Factory Automation workstation for applications that require a NEMA 12 enclosure (dust-proof and drip resistant).

The 8936 Series features a 15.1" Active Matrix TFT display and a ventilated enclosure constructed of epoxy-coated aluminum that meets a NEMA 12 rating. The standard features include a shatter-proof polycarbonate screen, sealed connector pathway, and an easy access drop down front panel for cable connections and filter maintenance. Options include a resistive or NFI touch screen, NEMA 12/4/4X keyboard with silicone rubber key pad and integrated Hulapoint Mouse, an 802.11B RF modem and/or CAT5E,



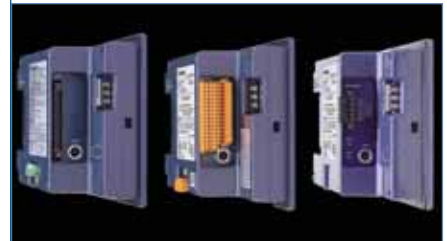
Most Christensen Display monitor configurations from 10 to 20 inch are now available listed and labeled for Class 1 Division 2 hazardous location use.

10/100BT NIC Ethernet connection, and flexible mounting for pedestal, wall, or pipe configurations.

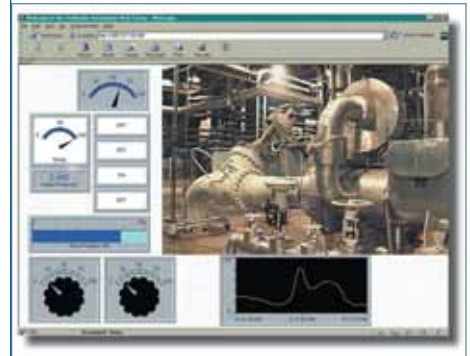
The 8936 Series standard computing platform consists of a Celeron 1.2 GHz CPU, 3 PCI slots, 1 AGP slot, a 10/100 NIC port, 3 serial, 1 parallel and 2 USB interfaces. Available options include Pentium P4, 1.8 GHz CPU, up to 512 MB DRAM, Net Boot capability, up to a 40 GB hard drive, up to 256 MB of Flash memory with a Windows NT/2000/XP operating system.

Combine the hardware and software

According to ARC Advisory Group (Dedham, MA; www.arcweb.com), with HMI



Xycom's new GLC models from left to right include the Type B+, H, and D.



FactoryCast, which allows users to view real-time process or machine information transparently, is at the heart of Schneider Electric's web-enabled Transparent Factory®.

software rapidly approaching commodity status, vendors are looking at ways to boost their revenues. One such way is to provide HMI software with hardware (as the PLC manufacturers have been doing) for a single box solution, or extend the functionality of HMI beyond its traditional push buttons, controls, and dialog boxes to that of MES and other higher-ended,



Owens-Illinois, Hamlet, North Carolina (right), recently added ten injection-molding machines to its facility. The electrical technician on the project, Don Hammann, designed a control system using AutomationDirect's DLO6 PLC interfaced with a 6" EZ-Touch color touch panel (left). This system controls two vacuum pumps, six material lines, and 10 feed hoppers. The system can be configured via the touch panel to run two types of material and to control which press receives the material.

full-function applications, where they can make some money.

One example of a PLC with built-in HMI software is Xycom's LT Series Graphic Logic Controller (GLC) Series. The original LogiTouch Series, released in 2001, already consisted of three different types: Type A with 32 points of I/O, built in; Type B with an interface that connects with the Pro-face brand of I/O called Flex Network; and Type C, which also has a Flex Network interface, but adds a serial port to talk to other controllers, temperature controllers or serial devices. All models of the LT Series have a 5.7 in. blue-and-white LCD with fully functional HMI features.



National Instruments LabVIEW 7 has new enhancements to make the HMI faster and easier to use.

New LT Series units consist of types B+, D and H. Type B+ is a combination of the Type A and Type B units with its built-in 32 points of I/O and Flex Network interface. Type B+ provides cost-effective built-in I/O with 16 inputs and 16 outputs (all 24 Vdc) and the ability to connect to the Flex Network line of distributed I/O. This space saving unit will also reduce the size enclosure once needed for this much equipment.

Another combined PLC/HMI is offered by AutomationDirect, which has expanded its line of EZTouch PLC touch panels to include new 8, 10 and 15-inch slim bezel units. The slim bezel panels are constructed with FDA-compliant plastic and touch screen overlay, and a ¼ in. FDA-compliant O-ring gasket. Slim-bezel EZTouch panels start at \$459 and

are available in color or monochrome versions. Certain models can also be purchased with built-in Data Highway Plus capability, and Ethernet option cards are available for use with Automa-

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tionDirect Ethernet-enabled PLCs. Also new are 10 and 15" panels with MOD-BUS Plus, DeviceNet, Profibus or Ethernet I/P capability.

HMI software: More powerful, farther reaching

As was suggested by ARC's comments noted earlier, to get around the problem of commoditization, vendors that intend to be successful need to develop HMI software that can do more. One good example of this approach at work is Siemens' new SIMATIC PCS 7/90 Operator Station, which allows for the migration of existing Bailey systems to Siemens technology. With the new operator station, Bailey INFI 90 and NET 90 users can migrate to the SIMATIC PCS 7 process control system. The new operator station can replace existing Bailey operator consoles while maintaining installed controllers, I/O and field wiring. The new operator station offers predefined faceplates and graphic symbols for interaction with Bailey block types, ensuring a consistent look and feel for operators, engineers, and maintenance personnel.

Making the HMI ubiquitous is the job of Schneider's Telemecanique® FactoryCast™ module. It embeds HMI capabilities such as e-mail, the ability to store user-created web pages, data logging and mathematical computations within PLCs and other devices. The module integrates a web server that acts as a real-time PLC data server, allowing information from Modicon® Quantum®, Premium™ and micro programmable logic controllers to be displayed in the form of standard web pages in HTML format, which can be accessed from any standard Internet browser. No configuration or programming of either the PLC or PC supporting the browser is required to access these capabilities. The module can be used in an existing configuration without any modification of the resident program.

The host of new features that National Instruments has added to its Lab-



GE Fanuc's CIMPLICITY runs on large and small hardware, and can be customized for local language operation.

VIEW 7 all work together to provide a faster, easier-to-use HMI. For example, some of the features include more than 35 revised shipping examples to help engineers better design and optimize their systems, more than 4,000 graphics in the image navigator, integration with LabVIEW Real-Time targets and OPC devices, new interactive tools to view and manage data from multiple computers,

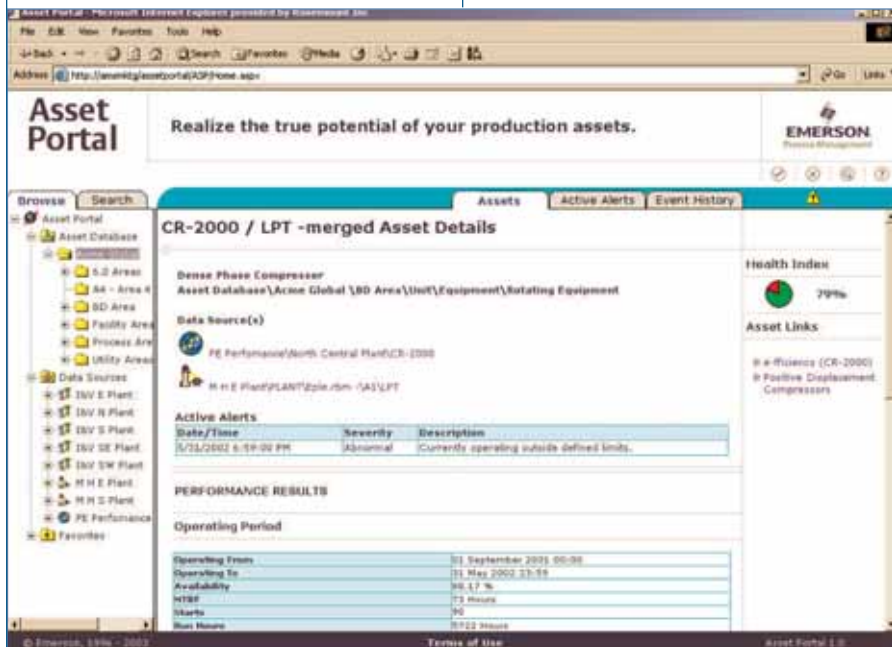
SQL 92 and ODBC 2.5 compliant database, and an enhanced historical database with faster performance. LabVIEW's Datalogging and Supervisory Control Module offers tools for designing and maintaining distributed monitoring and control systems. Development tools provide for logging data, alarms, and events; trending data and batches over time; and extracting data from the network database with standard SQL/ODBC queries.

Yokogawa has recently released the R3.01 version of its Alarm Event analysis software package. This tool categorizes event logs acquired from DCSs in terms of process requests (alarms, annunciators, etc.) and operator's actions (setting values, changing modes, etc.). By observing the balance of these alarms and events graphically, operation-related problems can be quantitatively clarified.

Putting it all together

A few years ago, Invensys began purchasing various controls companies—hardware and software. I remember visiting one Invensys acquisition located in the midwest and asking if the company would soon be applying I/A Series technology to its hardware. I was told that this was already in the works.

Today, the concept of an all-encom-



Emerson's Asset Portal provides a window into plantwide assets from anywhere in the world via the Web.

{special report}

passing, underlying architecture or platform technology is paying off for Invensys. The company's new Archestra™ software architecture will soon form the foundation for I/A Series control systems, the Foxboro A² automation system, Wonderware software solutions, and just about every product offering under the Invensys moniker.

To extend its HMI capabilities even further, Invensys has announced an alliance with Microsoft to create intelligent business solutions that will give customers real-time visibility into their production operations. Behind this is tighter linking of Invensys' Archestra framework with the ongoing evolution of Microsoft's .NET initiative and its Windows Server System (more on p 56). This alliance will provide real-time collaboration among the shop or plant floor, engineering, supply chain, and enterprise applications; robust, secure, and effective integration of existing customer applications; increased uptime and asset availability for managing multiple sites, integrating with partners, and optimizing complex supply chains; and proven solutions that will be reliable, flexible, scalable, and secure.

When you need mobility on the plant floor, you can now get Wonderware InTouch HMI for Microsoft Windows XP-based tablet PCs. Tablet PCs enable users to interact with the display in a manner that is similar to writing on a tablet. The InTouch HMI has also been enhanced to support the new tablet PC features, providing additional versatility to the end user. By the end of the first quarter of 2004, Wonderware also plans to provide complete pen and annotation support for tablet operating systems in its advanced plant intelligence monitoring clients, such as ActiveFactory reporting and analysis tools.

Another HMI supplier that has built its applications around the ever-evolving Microsoft .NET technology is Iconics. Its new BizViz™ Suite includes several new products that bridge the

gap between manufacturing and corporate business information systems. At the core of BizViz Suite are its new data-mining and Web portal technologies, written to take advantage of Microsoft's .NET and SharePoint™ Portal Server. The BizViz Suite allows the bridging of industrial or corporate databases and integrates information from different data sources, including Mi-

crosoft SQL Server®, Oracle®, SAP® ERP software, and OPC information. The BizViz Suite contains four products: ReportWorX™, PortalWorX™, BridgeWorX™, and MobileHMI™.

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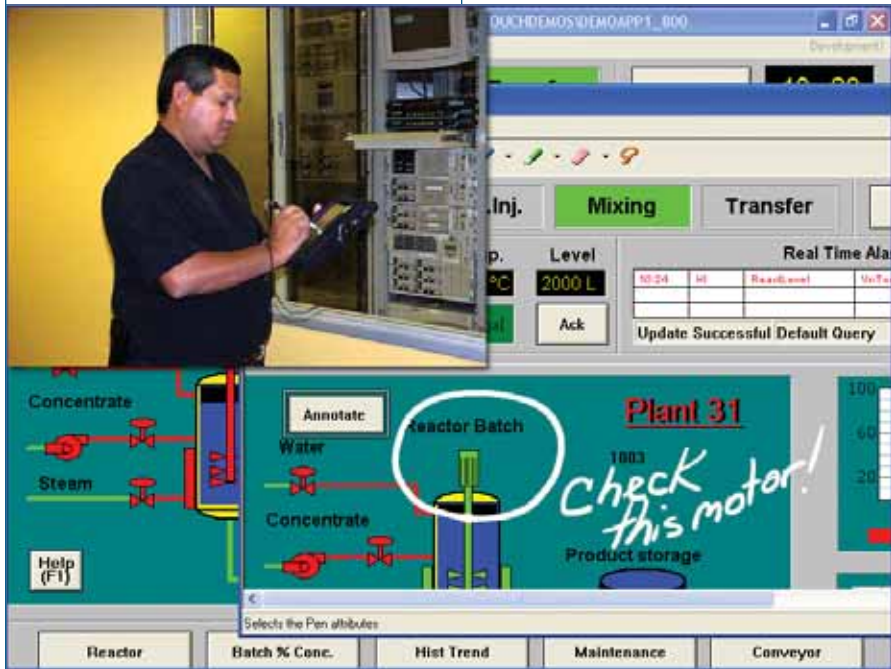
{special report}

connectivity will need to be capable of handling local languages. With the latest release of CIMPLICITY® HMI, GE Fanuc Automation Americas, Inc., an affiliate of GE Industrial Systems, delivers an array of features designed to extend both the connectivity and localization capabilities of today's global manufacturer. Featuring dynamic screen localization and connectivity enhancements to simplify exchange of data between plant floor and the enterprise, CIMPLICITY HMI 6.1 is a scalable and easy-to-use solution that allows users around the globe to quickly and easily implement this software solution and maximize the efficiency of their manufacturing processes. For global users, OEMs or system integrators that wish to customize HMI screens in their native language, CIMPLICITY HMI 6.1 delivers the ability to change the language of the screen and alarm text on the fly.

Key to HMI 6.1's connectivity enhancements is the ability to share data with Process Execution products such as CIMPLICITY Machine Edition, and Plant Intelligence products like iHistorian™, GE Fanuc's plant-wide data historian.

GE Fanuc's HMI/SCADA iFIX 3.5 software has been updated to provide manufacturers with powerful new project management, data accessibility and security features. Through this new functionality, manufacturers can reduce development time, improve enterprise connectivity and gain greater overall control of their production processes. With iFIX 3.5, users can develop, manage and alternate between multiple HMI/SCADA applications and projects from a single development station. As a result, corporations and system integrators can increase the agility, productivity, and effectiveness of their development personnel.

Sharing data among SCADA and other plant floor applications is also made easier using the iFIX Integration Toolkit. The toolkit delivers iFIX database access and development, as well as historical data access, and it now includes a .NET



Tablet PCs running tablet-based software, such as Wonderware's InTouch, make it easy for engineers and technicians to communicate problems over the plant network.

adapter to integrate with Visual Studio .NET. As a result, iFIX makes it possible for developers, system integrators and OEMs to leverage the latest software technologies available from Microsoft.

Getting process information from your HMI isn't all that you need today. An interface to your plantwide assets is

required as well. And you should have access to them anywhere in the world via the Web. Emerson Process Management's Asset Portal provides secure access to mechanical equipment, process equipment, instruments, and valves via Internet Explorer. Experts can view active alerts, as well as current and histori-

▶ HMI makes cutting and winding easy for German foil manufacturer

Wayne Labs, Senior Technical Editor

A recurring task in the manufacturing, processing and finishing of plastic and metal foils, papers and laminates is the cutting and winding of a long wide roll into multiple narrow and/or short rolls. Therefore, the main requirements needed for plant floor equipment are high flexibility and availability. However, this equipment must also provide the highest possible process transparency, and a convenient HMI system for reduced adjustment and process conversion times. Yet another critical requirement is the integration of the equipment's process data into enterprise networks for the analysis of process data.



The PSA GmbH (Bitburg), a young, dynamic company, has established itself as a global leader in this field in just a few years. PSA sees itself as an innovator, consistently using

cal asset details through the Asset Portal to expedite decision making. With Asset Portal, users can consolidate asset information from Emerson's Machinery Health Manager, Equipment Performance Monitor, and Intelligent Device Manager, and extend access to virtually anywhere. From a single Web browser, engineers can see data from a single facility or as a global organization. They can compare device configurations, look for trends in motor faults, and review compressor performance across the entire enterprise.

Honeywell Automation and Control Systems has made web-based technologies a key part of its new DCS, Experion PKS (Process Knowledge System). Experion PKS integrates Honeywell's HMIWeb technology, a Web-based architecture supporting integration of HMIs, application, and business data and Microsoft .NET and OPC technologies. This interface solution combines consistent and secure access, robustness, and performance with state-of-the-art, open web graphics.

HMIWeb technology offers the benefit of fully integrated data delivery using standard Internet technologies such as HTML and XML. HMIWeb technology supports casual access to process graphic

displays from either the secure Experion PKS Station environment or directly from Microsoft Internet Explorer without functionality-reducing "exports." This framework ensures seamless, third-party integration through open Web standards.

The DCS has a continuous, logic, sequential, and drive object-oriented control environment hosted on redundant controllers. System interfaces include FOUNDATION™ fieldbus, Profibus™, DeviceNet™, LON™, ControlNet™, and Interbus™. The system's DCS functionality is fully integrated with previous and current Honeywell systems, and functionality from new technologies such as the Alarm Monitoring Environment, VB scripting, and the Application Control Execution Environment is featured as well. Also included is an integrated safety system solution.

HMIs already so much more

HMI hardware and software offers so much more than simply a window into the process. It provides extended connectivity, project management, asset management, and additional functionality that can help optimize plant operations and lead to a very quick ROI. And there's a lot more to come. ■■■

universal automation technology offered by Siemens. Based on open specifications and available worldwide, the technology provides users greater independence from machine manufacturers—a benefit that PSA passes on to its customers.

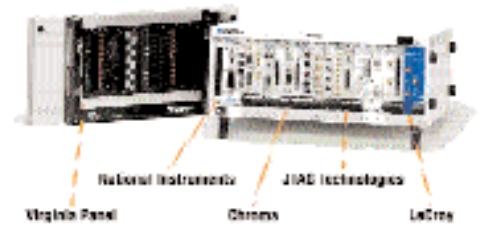
The latest development in automation technology at PSA is a combination of Siemens' SIMATIC Multi Panel MP 370 with 12 in. touchscreen, intuitive SIMATIC Pro-Tool HMI as well as a software PLC and drives on a PROFIBUS DP network. The Multi Panel with Windows CE real-time operating system, 64-Bit RISC CPU, and 12 MB of flash memory provides a fast, rugged and proven fail-safe platform for complex controller algorithms with up to 10 manipulated variables. Together with the WinAC software-based PLC and a master-slave configuration of the drives, the Multi Panel allows the track voltages at the winders to be controlled separately.

Once set up, the interface-less system works flawlessly. PSA ported the program from the previous hardware PLC to the software-based PLC without difficulty. Digital drive systems and precise control open up a wide processing window for products ranging in thickness from 5 µm to 1.5 mm.

At the onsite Multi Panel, the operator is guided through all setup procedures. From the touch screen, the operator can also make online changes to the automation process at any time, and directly influence the quality. The system meticulously documents everything, allowing the experience of the operator to be incorporated into detailed material profiles.

No hard drive and fans, a faceplate conforming to the IP65 degree of protection, and a mounting depth of only 59 mm make the MP 370 suited to application in rough industrial environments. Integrated Ethernet and USB ports provide network integration and connectivity for additional peripheral devices.

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Buying an OS? Remember, you're really buying a philosophy

Wayne Labs, Senior Technical Editor

Your options are many (Windows, Mac OS, Solaris, AIX, LINUX, plus others), and the commitment is major, so choose carefully

Did your boss ever tell you not to spec any sole source suppliers in your system design? What boss in his or her right mind wouldn't? Yet, we all spec sole source every time we opt to go with Windows, Mac OS, Solaris, AIX, or one of the other proprietary operating systems (OS) out in the market these days. At the same time, our other option—specifying LINUX, an OS into which nearly everyone in the world has free access via its source code—can make us conservative



FIG. 2: .NET applications on Linux is the focus of Ximian's Mono project. Mono Documentation Browser rendering a method description.

sorts a little uncomfortable as well. How do we know that the product is stable and secure? And how do we know that we have the latest version? These are tough questions.

Let's think about it another way: if your application calls for a 2-inch 6-32 machine screw, any manufacturer's screw will do the job as long as it meets your other mechanical specs. But what if there were only one manufacturer of this particular screw? How much would it cost? Would its cost seem as though it were plated with gold instead of nickel?

In this article, we'll look at the current trends in major operating systems—both at the client and server levels.

Windows XP

Debuted in February of 2001 and officially released on the 25th of October, 2001, Windows XP (Home and Professional versions) continues Microsoft's 32-bit path, which began with Windows NT and moved to Windows 2000. Some have argued that Windows XP (Fig. 1) is to Windows 2000 what Windows 98 was to Windows 95—a minor upgrade. Industrial software vendors, for the most part, had jumped on the bandwagon within six weeks to a year. Wonderware had enabled InTouch and ActiveFactory to support the new system within 50 days, and Iconics, for example, supported XP in its GENESIS32 6.1 in March of 2002.

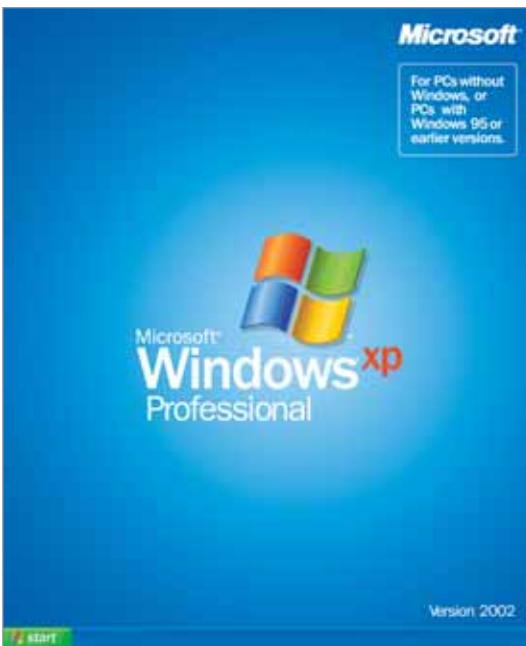


FIG. 1: Microsoft Windows XP is available in Home and Professional versions, and follows the 32-bit path of Windows NT.

{applying
technology}

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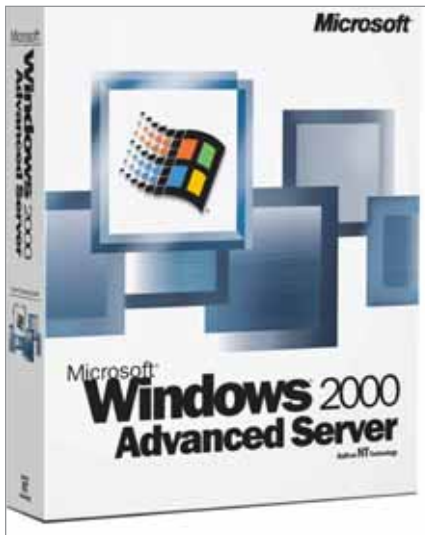


FIG. 3: Windows 2000 Advanced Server for datacenter applications grew out of Windows NT technology. Windows Server 2003 combines .NET technology and Windows 2000 Server technologies.

In Windows XP (both versions), Microsoft sought to make its OS more bullet-proof. For example, XP contains a system called Driver Signing, the net effect of which is that only Microsoft-certified and tested drivers are guaranteed to work. Yes, you can use drivers that aren't certified, but they may not function properly, or you may not be able to install them at all. Another hardening feature that Microsoft added is protection to keep you from writing over necessary DLLs when you install new (or older) programs. In the Professional version of XP, several updated administrator and remote admin functions have been added.

In the Home version, multimedia is the key, allowing home users to run the latest games. Just keep in mind that, next to real-time industrial control, games pose the greatest demands on any system. Microsoft has updated DirectX and Media Player, and has added new multimedia and video tools.

In both versions, Microsoft has recreated the GUI, attempting to make it simpler to use. Decide for yourself on this one. If you've been accustomed to

the Win 2000/98 or Mac look and feel, the new XP interface will take a little getting used. No doubt your first question will be, "Where did they put my ___?" (You fill in the blank.)

Windows XP Server???

If you've been looking for "Windows XP Server," it doesn't exist under that name. Several months ago I was informed by Microsoft representatives that this product would assume the moniker of Windows .NET Server. But don't bother trying to find this product on the Microsoft Web Site. Microsoft has renamed its server yet another time to Windows Server 2003, which does incorporate much of .NET's functionality.

.NET is Microsoft's strategy of linking suppliers, vendors, and manufacturers together in real time via the Web—providing the technologies that can assist in supply chain integration and management. The .NET initiative can be confusing because it is a company-wide effort that ranges from development tools to end user applications. .NET includes a development platform for

single-sign-on system that is being integrated into Windows XP.

Interestingly enough, there is an open source project underway to provide .NET functionality on the Linux platform. Ximian (www.ximian.com) announced the launch of the Mono project (<http://www.go-mono.com>), an effort to create an open source implementation of the .NET Development Framework. Mono includes: a compiler for the C# language, a runtime for the Common Language Infrastructure (also referred to as the CLR) and a set of class libraries (Fig. 2). The runtime can be embedded into your application. Mono has implementations of both ADO.NET and ASP.NET as part of its distribution.

Introducing Windows Server 2003

On a recent visit to Microsoft's home page, I found a link called "Why upgrade from Windows NT Server 4.0?" Clicking on it takes you to the Windows Server 2003 page. I'm sure that many of you may not have yet moved to Windows 2000 Server (Fig. 3) unless

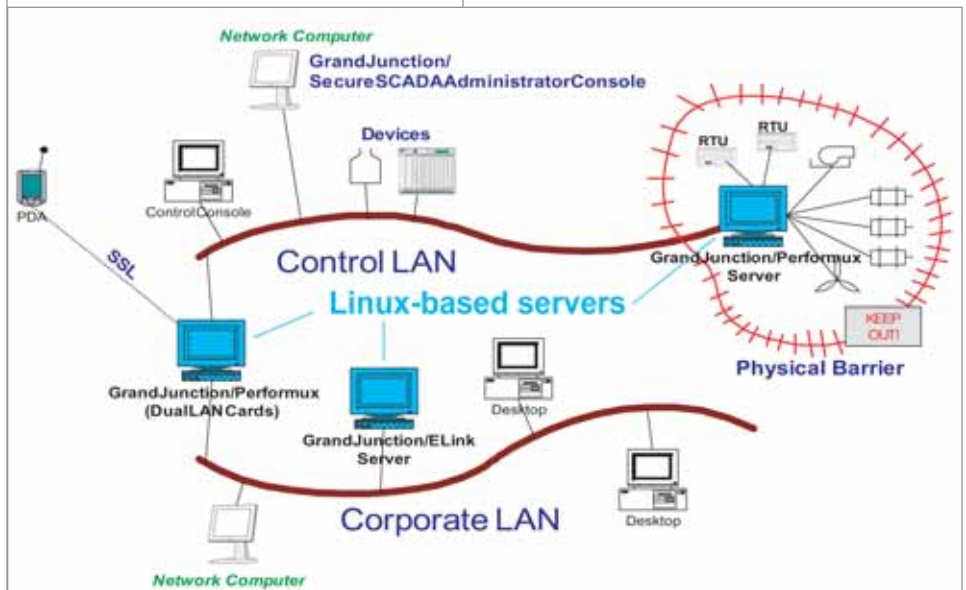


FIG. 4: Verano's Performux and SELinux can be combined to provide secure transmission of SCADA information wherever it's needed. Traditionally UNIX products, they are now available on Linux.

writing software, Web services, Microsoft server applications, new tools that use the new development platform, and Hailstorm, the Passport centralized sin-

your industrial software vendor/system integrator helped you make the move. At least a couple of vendors that I talked to are already testing the new server OS,

{applying technology}

and have verified that their products will run on it. If you're interested in some of the new and improved features that Windows Server 2003 will have, see the sidebar, "Windows Server 2003—New features."

Sixty-four bit systems are not too far off in the future. Built around Intel's new 64-bit Itanium® processor, Microsoft's Windows Advanced Server, Limited Edition is available as an OEM product on certain hardware products running the new Intel chip. The OS will become part of the Windows Server 2003 family in the near future. In addition to handling up to eight processors, the new OS will remove the current limit of physical addressable memory of 4 Gbytes and increase it to 16 terabytes. It will provide hardware error detection and prediction, be interoperable with 32-bit Windows, and support the familiar Windows programming model.

If you're looking for the Workstation version of this 64-bit OS, you'll probably find that Windows XP 64-bit will be made available to PC manufacturers in late spring or early summer, according to Microsoft sources.

Linux: On the desktop

While I'm not ready to do my Control Solutions International editorial work on Linux—mostly because the applications I use aren't available on it—I'm seeing emerging interest in desktop Linux. Much of this, however, is coming from vendors who traditionally provided UNIX* applications. A good example is Verano's (Mansfield, MA) Performux™, a SCADA application for large utilities. Based on the company's RTAP technology (formerly an HP product for HP-UX and other UNIX machines), the software (Fig. 4) provides real-time instant awareness, fast memory-resident database, a scan system to interface legacy plant devices, alarm and event management,

(*UNIX is a registered trademark of The Open Group in the United States and other countries.)



and dedicated HMI visualization in a Web-based display.

A second Linux product, Secure SCADA™, is compliant with NSA's SELinux (Security Enhanced Linux)

FIG. 5 (left): Red Hat Linux is available for several hardware platforms including the new Intel Itanium 64-bit processors.

extensions, manages and protects a system from cyber-intrusion, and provides an add-on security shield for existing control systems.

And if you do have a high-powered application that needs the additional memory and horsepower that an Itanium processor-based machine provides, Intel and Red Hat (Fig. 5) have jointly announced Red Hat Linux for HP Workstations zx2000 and zx6000. While this is certainly overkill for a HMI application, it's not for others. For example, these systems will handle high floating-point applications used by scientists and

Why upgrade to Windows Server 2003

Maybe you haven't yet upgraded to Windows 2000 Server. If you're still on NT Server, you may want to skip Windows 2000 Server and go right to Windows Server 2003. Here are Microsoft's selling points on why you should consider the upgrade.

1. Easy to deploy, manage, and use—With its familiar Windows interface, Windows Server 2003 is easy to use. New streamlined wizards simplify the setup of specific server roles and routine server management tasks. In addition, administrators have several new and improved features designed to make it easier to deploy Active Directory. Large Active Directory replicas can be deployed from backup media, and upgrading from earlier server operating systems such as Microsoft Windows NT® is easier with the Active Directory Migration Tool (ADMT), which copies passwords and is fully scriptable. Remote Installation Services help administrators quickly create system images and deploy servers.

2. Secure infrastructure—Windows Server 2003 lets organizations take advantage of existing IT investments, and extend those advantages to partners, customers, and suppliers by deploying key features like cross-forest trusts in the Microsoft Active Directory® service as well as Microsoft .NET Passport integration. Identity management in Active Directory spans the entire network, helping ensure security throughout the enterprise. It's easy to encrypt sensitive data, and software restriction policies can be used to prevent damage caused by viruses and other malicious code.

3. Enterprise-class reliability—Availability, scalability, and performance—Reliability is enhanced through memory mirroring, Hot Add Memory, and health detection in Internet Information Services (IIS) 6.0. For higher availability, the Microsoft Cluster service supports up to eight-node clusters and geographically separated nodes. Windows Server 2003 is faster with up to 140 percent better file-system performance as well as significantly faster performance for Active Directory, XML Web services, Terminal Services, and networking.

4. Lower TCO through new and improved tools—The Windows Resource Manager lets administrators set resource usage (for processors and memory) on server applications and manage them through Group Policy settings. Network-attached storage helps consolidate file services. Other improvements include support for Non-Uniform Memory Access (NUMA), Intel Hyper-Threading technology, and multi-path input/output (I/O), all of which help "scale up" servers.

5. Easy creation of dynamic intranet and Internet Web sites—IIS 6.0, the Web server included in Windows Server 2003, provides enhanced security and a dependable architecture that offers application isolation and greatly improved performance. Microsoft Windows Media® services makes it easy to build streaming media solutions with dynamic content programming as well as faster and more reliable performance.

{applying technology}

engineers that require large memory bandwidth and memory latency. These Itanium workstations have shown performance figures of a floating point SPCEfp2000 score of 1,400 achieved on the HP zx6000 1 GHz running Red Hat Advanced Workstation and Intel 7.0 compilers.

For the humble desktop

If you've tried any desktop version of Linux, you may be thinking that it's very close to being as easy to use as Win-

dows. However, a few things need work. For example:

- Changing screen color-depth and resolution are not easy under X-windows, and often requires running a command line or a primitive GUI to accomplish it.
- Fonts can be scattered all over the system rather than being in one location, and are not organized as in Windows or the Mac. Some Linux distributions include font managers to make installation easier, but results can be mixed.
- Lin-Neighborhood and gnomba are two solutions to Windows' Network Neighborhood or My Network Places, which try to make

SAMBA (Linux's PC networking "drivers") easier to use, but getting either one to work flawlessly can sometimes be a challenge.

- While there are many drivers now available for hardware, installing them is not usually automatic if you do it after the initial Linux installation.
- Besides GNOME and KDE GUIs, there are several others that you can use, almost making the choice more difficult than it needs to be.

Several vendors are attempting to make Linux a friendly desktop. One notable example is Lindows.com; others include Mandrake Linux 9.0 and Red Hat Linux 8.0.

Commercial interest in desktop Linux is increasing, and now there is a brand new show for it—dubbed the Desktop Linux Summit. The first was held in San Diego Feb. 20 and 21st. Several vendors made their presence known, including Lindows.com, Sun Microsystems, Bitstream, Microtel, Linux Professional Institute, OpenOffice.org, and others. The standard shows, such as LinuxWorld in New York, also featured many exhibits and conferences relating to desktop Linux—not to mention real-time embedded Linux and Linux for enterprise-level applications.

Linux servers grab market share

The Gartner Group predicts that the Linux server market will more than double by 2005, from \$1.8 billion to \$3.8 billion.¹ The problem, of course, with numbers like this is that, if you should decide to set up a Linux server yourself using an existing machine, and use free downloaded software from any Linux distribution, your machine isn't counted in the official market figures. What you gain in purchasing from a vendor like Red Hat (in addition to being counted in the official numbers) is that you get varying degrees of service based on what you're willing to spend. In addition, you get a Web-based update service just like you get with Microsoft's Windows Update Web site.

6. Fast development with integrated application server—Microsoft ASP.NET enables high-performance Web applications. With .NET-connected technology, developers are freed from having to write tedious "plumbing" code and can work efficiently with the programming languages and tools they already know. Existing applications can be easily repackaged as XML Web services. UNIX applications can be easily integrated or migrated. Developers can quickly build mobile-aware Web applications and services through ASP.NET mobile Web Forms controls and other tools.

7. Easy to find, share, and reuse XML Web Services—Windows Server 2003 includes Enterprise UDDI Services, a dynamic and flexible infrastructure for XML Web services. This standards-based solution enables companies to run their own UDDI (Universal Description, Discovery and Integration) directory for intranet or extranet use, making it easy to discover Web services and other programmatic resources. Developers can easily and quickly find and reuse the Web services available within the organization. IT administrators can catalog and manage the programmable resources in their network. Enterprise UDDI Services also helps companies build and deploy smarter, more reliable applications.

8. Robust management tools—Expected to be available as an add-in component, the new Group Policy Management Console (GPMC) allows administrators to deploy and manage policies that automate key configuration areas such as users' desktops, settings, security, and roaming profiles. A new set of command-line tools lets administrators script and automate management functions, allowing most management tasks to be completed from the command line if desired. The Volume Shadow Copy service improves backup, restore, and system area network (SAN) manageability tasks.

9. Empower users while lowering support costs—With the new shadow copy feature, users can retrieve previous versions of files instantly, without requiring costly assistance from a support professional. Enhancements to the Distributed File System (DFS) and File Replication service (FRS) provide users with a consistent way to access their files wherever they are. The remote access Connection Manager can be configured to give virtual private network (VPN) access to users without those users having to know the technical connection configuration information.

10. Expertise from a worldwide network of partners and certified professionals—Organizations have access to a wide range of solutions and expertise available worldwide, including 750,000 partners delivering hardware, software, and services as well as 450,000 Microsoft Certified Professionals (MCPs).

Find more on this on Microsoft's Web site at <http://www.microsoft.com/windows.net-server/evaluation/whyupgrade/top10best.aspx>

{applying technology}

What's helping to promulgate Linux servers is the support being given the technology by the big hardware companies (e.g., SGI, SUN, HP and IBM). Pushed along by IBM's strong support of Linux from the hardware, middleware,



FIG. 6: IBM's Linux Web site can be found at <http://www.ibm.com/linux>

and database environments (Fig. 6), vendors such as L-Soft, with its LIST-SERV® product for UNIX and IBM S/390 systems, have joined the effort to offer more and more application products on Linux. Another prime example is SAP's enterprise software application server, which is supported on IBM's hardware (zSeries 64-bit) and DB2 database platforms (Fig. 7).

An increasing number of companies are running virtual Linux systems inside IBM S/390 mainframe computers to reduce hardware and operations costs. Thousands of virtual Linux systems can run on a single mainframe in this manner. Hardware or software upgrades can be installed in much less time than it would take with thousands of separate servers.

Clustering for power in Paris

The clustering capability of Linux has made it attractive for high-end applications. For example, Paris, France-based Compagnie Générale de Géophysique

(CGG) performs geophysical surveys and provides three-dimensional images of Earth's subsurface that enable oil companies to pinpoint reserves before committing drilling dollars. To help grow its 16% share of the \$3.8 billion seismic services market, CGG is relying on massive computing capabilities.

Says Dave Jones, CGG's business development manager, software sales, Europe/Africa, "Compared to our classic large server solution, adding another rack of clusters is a simple matter. And Linux scales up to thousands of machines, which answers the problem of our exploding data volumes."

CGG's cluster solution consists of 512 dual-processor IBM xSeries 330 1GHz Pentium III servers (Fig. 8) at the company's London location and 128 identical servers in Paris, France. The IBM servers run Red Hat Linux, and the two clusters are networked, allowing CGG the flexibility to run jobs wherever capacity exists. While IBM provided technical support, Paris-based IBM Business Partner and Linux specialist Adequat provided a turnkey solution, installing the Linux operating system and racking, stacking and connecting the

servers. IBM and Adequat will perform ongoing support for the clusters. IBM Global Services assisted in the financing of the project.

With its Linux clusters, CGG has 1.25 teraflops of processing power, or five times the company's previous capacity. Given its need to obtain the best price/performance and lowest total cost of ownership, CGG is understandably pleased. Says Jones, "Our IBM and Linux solution saves up to 50% of the cost of alternative enterprise server solutions delivering comparable capabilities." 2

Another example of clustering comes from MSC Software, a global provider of simulation software, services, and systems. Nittetsu Plant Design, an affiliate company of Nippon Steel Corp., announced that Nittetsu's System Engineering Department has selected MSC.MarcDDM (Domain Decomposition Method) and the MSC.Linux cluster system to solve complex engineering problems. Nittetsu Plant Design specializes in designing iron-making processes and environmental plants.

For Nittetsu's evaluation of the MSC.MarcDDM and MSC.Linux technologies, MSC.Software conducted a bench-

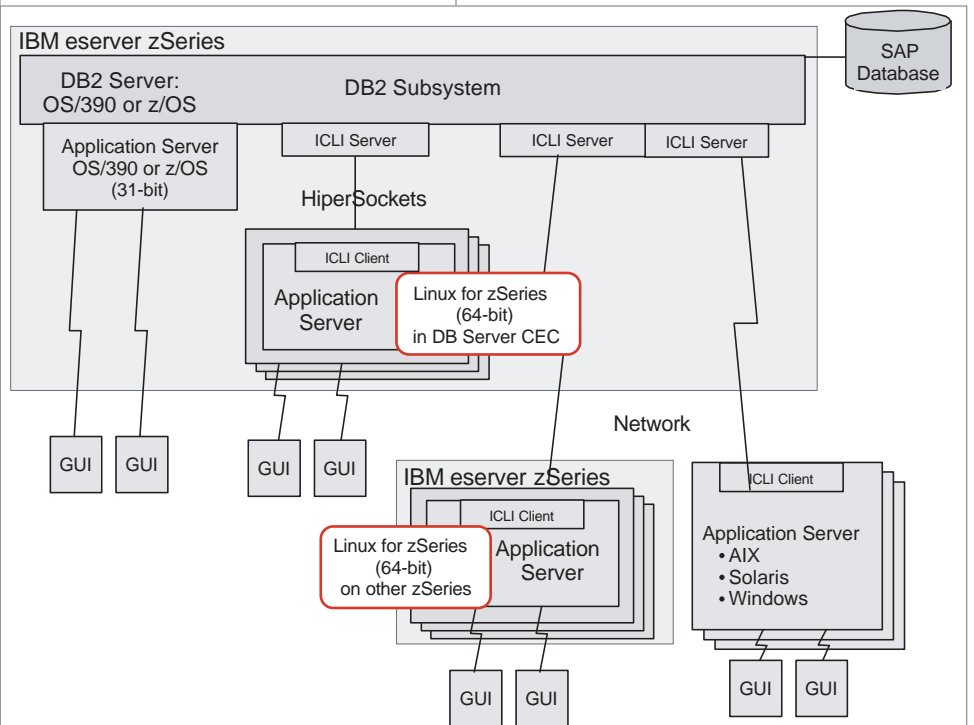


FIG. 7: With the SAP Application Server on Linux for zSeries, users have added freedom of choice in selecting the appropriate SAP implementation environment.

{applying technology}

mark study on thermal and stress analysis on both UNIX and Linux environments. This benchmark showed that analysis performed under a Linux cluster is significantly faster than UNIX for thermal and stress analysis.

“Nittetsu Plant Designing Corporation expects further efficiency in the design process for in-house and engineering phenomenon which has not been examined conventionally by performing more analysis case testing as well as large-model analysis with DDM parallel computing capability in MSC.Marc under Linux cluster environment,” said Atsushi Yumoto, System Engineering Department of Nittetsu Plant Designing Corporation.

Security: Important no matter the platform

If you think that you’re secure because you run a Linux, UNIX, or Mac OS platform, rather than Windows, think again. According to an *AberdeenGroup Perspective* (Vol. 1 No. 35, 11-12-2002), open source software, commonly used in many versions of Linux, UNIX, and network routing equipment, is now the major source of elevated security vulnerabilities for IT buyers. Security advisories for open source and Linux software accounted for 16 out of the 29 security advisories—about one of every two advisories—published for the first ten months of 2002 by CERT (www.cert.org, Computer Emergency Response Team). Keeping pace with Linux and open source software are traditional Unix-based software products, which have been affected by 16 of the 29—about half of all—advisories during 2002. During this same time, vulnerabilities affecting Microsoft products numbered seven, or about one in four of all advisories. (For more on this, see

<http://www.aberdeen.com/2001/research/11020005.asp>.)

But if you are using Windows, be sure to stay on top of security patches and bug fixes. You can do it from the Windows update site. If you’re running Windows 2000 (Server or Workstation), Windows XP or later, you can set up the system to automatically update itself as it



FIG. 8: IBM's xSeries 330 1 GHz dual processor Pentium servers combine to form economical clusters of Linux computers. Courtesy IBM.

downloads fixes and patches from the Microsoft Web site. Although I’ve never

experienced any problems with these updates, some people have had problems with machines that do not restart. An issue is that several Windows 2000 Server and Workstation patches insist that you restart the machine after applying the patch, which is definitely not too convenient if you have to interrupt a batch process you have going. In most cases, UNIX and Linux patches do not involve restarting the computer. ■■■

References

- ¹(<http://www.lsoft.com/news/S390.asp>)
- ²(<http://www-3.ibm.com/software/success/cssdb.nsf/CS/NAVO-4YXQAW?OpenDocument&Site=linuxatibm>).

► The future of Linux in China

I recently interviewed Yufang Sun, chairman, board of directors, of Redflag Software Co. Ltd based in Beijing to get a better handle on Linux’s penetration in the Peoples Republic of China. Red Flag, according to Sun, has been busy localizing Linux for China, educating the market, and developing more applications with partners. The three-year-old company has already successfully sold Linux into government, education, railways, post office, and banking applications. It sold more than 1 million desktop versions in 2002.

Red Flag, however, uses a different approach to Linux than U.S. vendors, explained Sun. “The market in China is a little different from the U.S. A comprehensive line of Red Flag Linux solutions has been introduced. These include Red Flag Linux Desktop, a Linux Server product spanning from low-end to high-end, Red Flag Embedded Linux for set-top boxes, PDAs, and thin clients plus industry solutions based on the Red Flag platform.”

I asked Sun what is the future of real-time Linux in China. Sun: “We provide a soft real-time feature for customers. Linux has a lot of code that can not run on a hard real-time Linux kernel. Now real-time in China is handled by RTOSes like VxWorks and QNX, and other home-made OSes such as HOPEN, Zyco, Elix, etc.” However, Red Flag’s embedded product, ControlLinux, has found its way into POS devices, controllers, and medical devices. Although most Chinese engineers are not writing their own RTOSs, according to Sun, they’ve been looking at ways to substitute embedded Linux for commercial RTOSs when and where they can.

According to Sun, “Linux has made amazing progress in the last two years, especially in localizing it to China. It looks and works quite similarly to Windows. Both are based on GUIs and, meanwhile, there are equivalent Windows applications on Linux, (e.g., to replace Word, Excel, PowerPoint, Media Player, etc.)”

Linux competes against other UNIXs and Windows in China. Noted Sun, “There are several UNIX versions, such as IBM AIX, HP-UX, SGI Irix, Sun Solaris, SCO UNIX; Linux such as Red Flag and CS&S, etc.; and Windows. UNIX versions usually are used in middle and high-level servers. Linux versions are used in servers, desktops, and embedded systems; and Windows versions are found usually in low-level servers, especially x86 servers and desktops. In desktops Windows has about 90% volume.”

Finally, Sun stressed that his company is not an island. Relationships with U.S. companies are very important. “Almost all leading IT companies are in the U.S. We have close relationships with IBM, Intel, HP, Oracle, and others. We are a software platform distributor, and every IT player is our partner.” In addition, Sun expects to be a key player in the Open Source communities, sharing the Chinese localization work it’s done.



FIG. 1: Columbia Research Labs' SA-122SE miniature force balance accelerometer can be used in lieu of strain gage accelerometers.

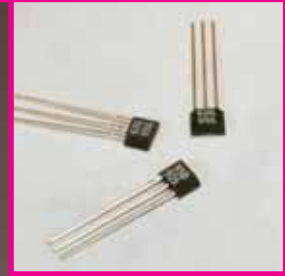


FIG. 4: Honeywell's miniature ratiometric linear (MRL) Hall effect sensors provide vibration sensing, level sensing, and weight sensing.



FIG. 2: Dover Flexo Electronics' low tension transducer can measure tension down to 3 grams.



FIG. 3: IMI Division's Model 607A11 accelerometer withstands industrial environments and can be used to monitor rotating machinery.



(Right): Rockwell's ColorSight™ 9000 color recognition sensor

Industrial sensors: Smarter, smaller, simpler to use

Wayne Labs
Senior Technical Editor



Fig. 5: Wilcoxon's Zerkometer works through common zerk fittings to measure pressure.



FIG. 6: Meriam Instruments' enhanced H2O sensor with added 20-in. range has an accuracy of $\pm 0.1\%$ fs with resolution to 0.001 inch.



FIG. 7: Setra's Model 209 pressure transducer is priced at \$99 for OEMs and is guaranteed to ship within three to five business days.

Background photo courtesy
of Rockwell Automation

Smarter, smaller, and simpler to use are the watch words for today's sensing devices. Though these terms have been used to describe previous generations of sensors, they take on a whole new meaning as applied to the characteristics and capabilities of the newest sensor technologies.

Take, for example, the term *smarter*. Until very recently, smart would likely have been used to describe a sensor with built-in signal conditioning and communications. Currently, smart refers to the ability of a sensor to perform diagnostics and make decisions. Indeed, Invensys (London, UK) and Oxford University have just announced new sensor technology they term "Sensor Validation" (SEVA). SEVA allows built-in sensor condition monitoring and self-validation for a wide variety of field instruments, and combines networking and software to reduce downtime and improve product quality while lowering operating costs. How does this work? Most smart sensors produce an error code when something goes wrong. In most cases we know that the sensor may need to be cleaned or replaced, but we don't know how the sensor output under this fault condition really affects the process. With SEVA, a validity index (VI) is generated for each measurement, which describes the quality of the measurement. The VI is used by the control system to take operational decisions in response to any sensor fault.

How about *smaller*? Yesterday's *small* would be considered at best medium by today's standards. Subminiature sensors the

Sensors used in the manufacturing arena continue to advance in form and function—giving users an ever-wider selection of sensing solutions from which to choose.



FIG. 8: Kavlico's P4000 pressure sensor withstands the abuse given to it by hydraulic applications.

size of a thumbnail are starting to come onto the market. And it's a safe bet that before too long there'll be a flood of them offering a host of different functions.

As sensors shrink in size, says Omron's Mike Frey, sensor product marketing manager, "they must also be simpler to use. The trend is to incorporate push button programming into these devices, eliminating potentiometers that wear out prematurely." Also making these devices simpler to use is the communications and calibration software that's typically included.

In this article, we'll highlight the features of the latest sensor technologies, and provide practical application information to help you put these devices to work. Only those vendors responding to our editorial survey were included in the article.



FIG. 9: Druck's PTX/PMP 1200 Series pressure transmitters can be used in IS applications and pressures up to 10,000 psig.

Force and acceleration

If you have an application that uses older strain gauge accelerometers, and you need more accuracy, you may want to upgrade to force balance units. An example of a force balance accelerometer is Columbia Research Labs'

(Woodlyn, PA) Model SA-122SE, which covers ranges from ± 0.1 g to ± 100 g, works with +5 to +12 Vdc excitation, has a ± 1.0 V output, and functions in temperatures from -55 to $+175^\circ$ C. The device (Fig. 1) has a constant scale factor and bias over its +5 to +12 V excitation range.

Another device that measures force for a specific application is Dover Flexo Electronics' (Rochester, NY) LT low tension transducer. This compact transducer (see Figure 2) is available in two mounting configurations, and is used in applications such as filament winding, fiber processing, and materials processes that require accurate tension measurement at very low levels. Load ratings range from 50 g to 2000 g. The device can accurately measure tension on loads to as low as three grams.



FIG. 10: Omega's PX921 Series radio-based pressure transmitter can relay your data from locations where you don't have wires.

Vibration sensors

A popular application for accelerometers is vibration measurement, and often the installation location is extremely tight. A device

that can fill this need is PCB Piezotronics' IMI Division's (Depew, NY) Swiveler™ Model 607A11. It (Fig. 3) has a $\frac{9}{16}$ in. footprint with 360° cable rotation. The sensor's stainless steel body allows it to be used in dirty, oily, industrial environments. It has a reference sensitivity of 100 mV/g and a frequency range to 10 kHz (± 3 dB), making it suitable for route-based or monitoring of rotating machinery.

Another type of sensing device that's well suited to vibration monitoring is the Hall effect sensor. When size is important—along with accuracy and/or temperature performance—you might want to try Honeywell Sensing and Control's (Freeport, IL) Hall effect SS495B/SS496B MRL devices. These have a list price of \$2.05, and can be used in everything from vibration applications to current sensing, motor control, position sensing, level sensing, and weight sensing. The sensors (Fig. 4) are operated by the magnetic field from a permanent magnet or an electromagnet. They respond to either positive or negative gauss. Integrated circuitry and laser-trimmed thin-film resistors provide temperature stability and sensitivity. The products have a typical sinking/sourcing output of 1.5 mA and use 7 mA of supply current at 5.0 V. Operating temperature range is from -40 to $+150^\circ$ C.

Wilcoxon Research (Gaithersburg, MD) has a potential solution for those who have machinery in which they need to monitor vibration at key areas such as bearings, but have no good place to mount the sensor. If your machinery has a zerk grease fitting at the bearing, you can mount Wilcoxon's new Zerkometer in place of the grease fitting, and you'll have an accelerometer plus grease fitting when you're finished (Fig. 5). This special-mount accelerometer has a sensitivity of 100 mV/g and an acceleration range of 80 g peak. Amplitude nonlinearity is 1% and frequency response is ± 3 dB from 0.5 to 8,500 Hz (resonant frequency is 23 kHz). The device works in temperatures from -50 to 120° C and can withstand a maximum vibration of 500 g peak.

Pressure sensors

Pressure measurements, of course, are a key measurement in continuous process operations, but they're important in discrete manufacturing as well. If you need to make accurate low-pressure measurements, give

some thought to Meriam Instruments' (Cleveland, OH) new H₂O sensor with an added 20-in. range. The sensor will measure differential pressure, vacuum and gauge pressure of clean, dry gasses with an accuracy of $\pm 0.1\%$ fs and with a resolution to 0.001 in. H₂O. The 20 in. DP sensor can be used in applications with static pressures up to 150 psig when pressurized on both the high and low pressure ports simultaneously. The sensor (Fig. 6) can be used in the company's 350 Series Smart Manometer, Meri-Cal II digital calibrators, 2110 Series smart pressure gauges, and the Model 1500 transmitter.

For OEM industrial applications Setra Systems (Boxborough, MA) offers the Model 209, which covers pressure ranges from 0-25 to 0-1000 psig and has $\pm 0.25\%$ fs accuracy, 0.10% hysteresis, stability of 0.5% fs/yr, and pressure ranges as low as 0-1 psig. This transducer (Fig. 7) withstands shock and vibration, thermal shock, RFI and corrosive media. The sensor has dimensions of 1.62 in. (dia) x 2.24 in. end to end.

Another OEM pressure sensor specifically designed for hydraulic applications is Kavlico's P4000, which uses MEMS sensor technology within an all-welded, stainless steel package. The sensor family (Fig. 8) is available in pressure ranges of 0-100 through 0-6,000 psi absolute or sealed gage. The devices have a maximum error of $\pm 1\%$ over the temperature range of -20 to +100°C.

If you're looking for a pressure transmitter that meets intrinsically-safe (IS) specs, check out Druck's (New Fairfield, CT) PTX/PMP 1200 Series of rugged piezoresistive pressure transmitters that withstand 400% overpressure and are available with fs ranges from 5 through 10,000 psig/psia. Outputs include two-wire (4-20 mA) and low-power (three-wire) 1-5 Vdc. Ranges below 1,000 psig are equipped with a flame-arresting filter. The transmitters (Fig. 9) are UL- and CUL IS-certified to Class I, Div. 1, Groups A, B, C, D.

Where high accuracy is a necessity, check out Mensor's (San Marcos, TX) 6000 series digital pressure transmitters, which cover ranges from 0-1 psi up to 0-6,000 psi with a resolution of 1 ppm. They work with RS-232C/422 systems and provide up to 50 readings/s at distances up to 4,000 to a host device. Temperature compensation for the stain-

less steel device covers 0-50°C.

If you need accuracy and NIST traceability, Ashcroft's (Milford, CT) K Series transmitter is now available in 22 pressure ranges, eight process connections, eight output signals and seven electrical terminations. Three accuracy classes are available, depending upon your needs. A NIST calibration test certificate is available with each transmitter.

"And now for something completely different..." Suppose you need a pressure reading from a location in which you don't have wires. Omega Engineering has a solution in its PPX921 Series wireless silicon-on-sapphire pressure transmitter. You can operate it from batteries or an external 10.5-30 Vdc supply, and it's available in ranges from 0-5 to 0-15,000

psi and 0-0.5 to 0-1,000 bar. It has rugged stainless steel construction and has a built-in license-free radio transmitter that sends its signal up to 500 m to a secondary transmitter that's wired into your system. You can get more information on this 12-bit, NEMA-4/IP65 device (Fig. 10) using Omega's fax-back number at 800-848-4271; key in document #3255.

Other pressure measurement options for specialized applications include Endress + Hauser's (Greenwood, IN) new Cerabar M (see Figure 11), which is available for measurement ranges from 4 in. H₂O to 6,000 psi with a turndown of 10:1 and an accuracy of 0.2%; and Moore Process Automation Solutions' (Spring House, PA) XTC Critical Transmitter (Fig. 12), which is a silicon dual capacitive pressure sensor and custom ASIC pair that meets TÜV AKs specs for critical processes. E+H's transmitter can be used in sanitary applications, and Moore's sensor can be used in chemical, pharmaceutical, power,



FIG. 11: Endress + Hauser's Cerabar M has a ceramic sensor and 0.2% accuracy.

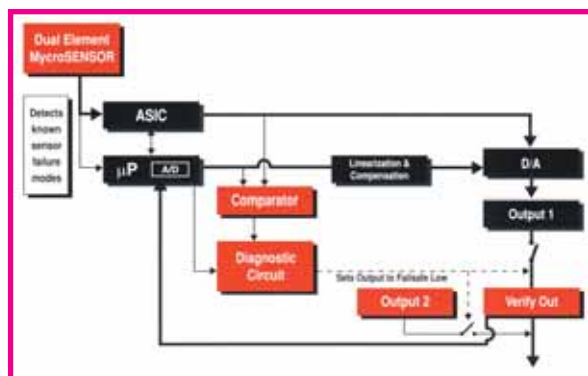


FIG. 12: Moore's XTC Critical Transmitter includes dual processors with comprehensive self-tests plus a secondary shutdown path.



FIG. 13: Automationdirect.com has increased the capabilities of its Centsable line of proxes.



FIG. 14: Siemens Bero family of advanced proximity, ultrasonic, photoelectric, and electromechanical sensors and switches.

and pulp and paper applications.

If you need more than just pressure measurements, a multi-variable transmitter can fill the bill. Foxboro's recently released IMV30 multivariable transmitter measures differential pressure and absolute pressure within a single polysilicon chip. It also transmits process temperature from a separate temperature sensor and provides flow rate calculations. Users can select instruments for pressures up to 300 or 1,500 psia, with maximum differential pressures of either 200 or 840 in H₂O. The maximum overrange pressures are 1200 psia for the 300 psia units and 2250 psia for the 1500 psia units.



FIG. 16: The Banner Flat-Pak sensing head fits into tight locations where barrel-style heads may not fit.

Proximity sensors

Proximity sensors typically measure the presence or absence of an object. More advanced devices, which we'll cover later, go beyond this capability and can measure actual distances to an object, or detect its color or shape. Proximity sensors use several different technologies such as ultrasonic, capacitive, and photosensitive—although the latter are usually known just as photosensors.

Improvements are constantly being made to these devices. For example, you can find more and more hardened devices to handle the really tough jobs.

Automationdirect.com has added capabilities to its **Centsable™** proximity sensors (Fig. 13). Two-wire dc proximity sensors in 12, 18, and 30 mm dia. work with sinking or sourcing PLC input modules, have very low leakage current, and are offered in embedded cable and quick-disconnect versions. Twelve and 18 mm stainless steel four-wire dc proxies provide IP68 (submersible) protection with the quick-disconnect cable fully locked.



FIG. 17: Rockwell's Allen-Bradley RightSound ultrasonic proximity sensor handles clear and translucent objects.

Siemens (Alpharetta, GA) recently released its complete line of Bero™ proximity, ultrasonic, photoelectric and electromechanical sensing devices (Fig. 14). Proximity sen-



Fig. 15: Carlo Gavazzi's Tripleshield sensor withstands harsh conditions including ESD.

sors are available in self-contained threaded and nonthreaded cylindrical versions from 3-30 mm, miniature block, limit switch style and 80 mm x 100 mm for long-range sensing. Sensing ranges cover from 0.6 mm to 75 mm. Ultrasonic devices detect most materials from 6 cm to 10 m, and are available in several styles and sensing ranges. For demanding applications, the vendor's SONPROG software and PC interface offer easy configuration of application-specific parameters including blind zone, near/far sensing limits, digital and analog outputs, sampling rates, etc. Photoelectrics are available in 4, 5, 12, 18 and 30 mm self-contained tubular sizes and cubical housings; they are also available in quick-connect or cable versions.

Capacitive proxies can be made to withstand the harshest of conditions, and Carlo Gavazzi has come up with what it calls Tripleshield™ sensor (Fig. 15) protection, which is said to withstand electrostatic discharge (ESD), burst, airborne and wire conducted noise and surge, meeting EN 50082-2 specs. The Tripleshield proxies are available in M18 or M30 cylindrical housings in thermoplastic polyester or stainless steel, and also in flat-pack polycarbonate housings and in cable and plug versions.

Small is the name of the game for Banner's (Minneapolis, MN) remote ultrasonic sensor, which has dimensions of 27.5 mm square and a height of 12 mm. Designed for use with the company's Q45UR sensors, the remote head (Fig. 16) includes integral thermistors that compensate for temperature variations to assure accuracy at the sensing point. Housed in rugged plastic, the Flat-Pak head is rated IEC IP65 and NEMA 4, and oper-

ates in temperatures from -25 to +70° C. An integral 2 m cable allows quick and easy connection with Q45UR ultrasonic controllers. Users can define a sensing window from 5 to 200 mm; analog models provide 0.1 to 0.5 mm resolution within a 50 to 250 mm range.

What if you need to detect clear objects? Notes Dave Rittenhouse, product manager in Rockwell Automation's Presence Sensing Business, "Setting up trouble-free clear object detection has traditionally been a challenge. This is especially true in wet or contaminated manufacturing environments." Rockwell's



FIG. 19: The Turck Q10S inductive proximity sensor features short circuit protection and is available in NPN and PNP complimentary outputs in the 3-wire dc versions.

RightSound ultrasonic beam sensor (Fig. 17) is rated at 1,200 psi washdown and has an emitter volume adjustment, which allows for a 2-30 in. sensing range. In the RightSound system, a separate emitter and receiver set up a unidirectional sound beam that can be broken by clear, opaque and translucent objects and materials, making it suitable for bottling, packaging and material handling.

If you need an ultrasonic prox that can withstand corrosive materials such as boric acid, ammonium hydroxide, tannic acid, electroplating solutions, etc., you may want to try Hyde Park's (Dayton, OH) Superprox Model SM902A-7-STS, which has a one-meter range and is 30 mm in diameter. The device (Fig. 18) can detect levels of caustic liquids, solids and powders as high as 120 mm from the stainless steel face. All versions of the sensor operate on 12-24 Vdc and can be selected with either NPN or PNP outputs. Response times range from 1.0 s to as fast as 150 ms. Minimum (default) level or position control

limits can be set to a width of 12.7 mm.

Inductive proxes

Say you need a compact sensor for valve position sensing, clamp detection, and other limited space applications. One possible solution is Turck's (Minneapolis, MN) Q10S. Its dimensions are 10.2 mm high by 16.0 mm wide by 28 mm long, allowing it to fit and function in confined areas where standard sensors will not. The device (Fig. 19) achieves a 2 mm sensing range with a repeatability of $\leq 2\%$ of rated operating distance, even when fully embedded in steel. The sensor is available in three-wire, 10-30 Vdc; two-wire, 20-250 Vac; plus a two-wire, 5-30 Vdc NAMUR version that meets DIN 19234 requirements. It withstands washdowns, operates in temperatures from -25 to +70° C, and is rated NEMA 1, 3, 4, 6, 13 and IEC IP67.

Pepperl+Fuchs solves one of the more difficult applications with its new MB-F32 (Fig. 20). This magnetic field sensor detects a piston through steel or other ferromagnetic cylinders up to 1/4 in. thick without the need for bore holes. The sensor determines the position of a piston anywhere within the cylinder by detecting the field change from a magnet system attached to the piston. This noncontact sensor can be mounted at any point on the cylinder wall for greater sensing flexibility. The MB-F32 is a dual-output sensor (NO or NC) available in either cable or quick disconnect versions. An optional software kit is available to assist with the magnet system design.

Position devices

There are several technologies—in addition to proximity sensors—that can be used to measure position. These range from purely mechanical to magnetic (LDVTs), laser, and optical.

Mechanical devices

Traditional mechanical devices—often known as cable-extension position transducers—use a string or wire that works much like



FIG. 18: Hyde Park's ultrasonic prox works with corrosive materials and can be used in level sensing.



FIG. 20: Pepperl+Fuchs' MB-F32 magnetic field sensor can detect a piston within a cylinder.



FIG. 21: Celesco's PT1 Series weighs a pound and can measure linear distances up to 50 inches.



FIG. 22: Synnate Controls' Cable Sensor works at distances from 0.1 in. to 500 ft.



FIG. 23: Quantum Devices QD110 Size 11 encoder features 2,048 lines/rev.

a standard tape measure. They're often coupled with an encoder that keeps track of how much string is doled out. SpaceAge Control (Palmdale, CA) is adding to its line of miniature position transducers by offering the Model 300185 position transducer for demanding industrial control environments. As an alternative to rod and cylinder products, this sensor uses a stainless steel cable wound around a spring-powered machined drum. The bearing-mounted drum is mated to an optical incremental encoder. The sensor measures up to 118 in. of travel and has external dimensions of 4 in. dia and 2.425 in. wide. The NEMA 6 (IP68) rated device works in temperatures from -40 to 185° F, and withstands 100 g/15g shock/vibration. Operating lifetime is in excess of 5 million full-stroke cycles.

Another option is Celesco's (Canoga Park, CA) PT1 Series compact transducer. This device has a measuring range of 0-2 to 0-50 in., and has 0-5 or 0-10 Vdc potentiometric, incremental encoder and 4-20 mA/0-20 mA outputs. The enclosure (Fig. 21) is approximately 4 x 4 x 2 in. and is rated NEMA 4/IP65.

Yet another option is the Cable Sensor™ from Synnate Controls (Seaside, CA). This device (Fig. 22) has a sensitivity of 0.1 in., and dynamic range is greater than 72 inches. Sensed area capacity extends from 0.1 in. to 500 ft. A total of five relay and open collector outputs are available for alarms and control.

Encoders: Small and accurate

Small is the name of the game for Quantum Devices' (Barneveld, WI) Model QD110 size 11 high-resolution encoder, which features 2,048 lines/rev. direct read, differential and SE outputs, and IP50-rated sealing in a package just a little larger than one-inch in diameter. The encoder (Fig. 23) has a nickel-coated carbon fiber composite housing, which provides EMI shielding. Input voltage is 5 Vdc, and outputs include RS-422A line driver, TTL, and ET7272 line driver with quadrature or indexed formatting.

If you're looking for a hollow-shaft encoder that works in machine control, process control and weighing applications, you might want to consider BEI Industrial Encoder Division's (Goleta, CA) HS25 2.5 in.

dia. hollow shaft encoder. It features dual bearings and shaft seals for NEMA 4, 13 and IP 65 environmental ratings, rugged metal housing and a cable gland. It accommodates shafts up to 0.75 in. dia, and is two in. deep. It mounts with an anti-rotational single screw clamp.

While encoders can be used to measure rotational or linear position, capacitive technology can also be used to measure relatively short distances, or strokes. Case in point: GMC Instruments' (Lake Zurich, IL) Kinax SR-709 capacitive sensor (Fig. 24) can be used to measure strokes from 10 to 140 mm for use with control valves and field control devices. These 4-20 mA transmitters are based on a differential capacitor system, and can withstand vibration and other harsh conditions. Typical power supply requirement is 12-33 Vdc, and ac isolated versions are available including an intrinsically-safe version.



FIG. 24: GMC Instruments' SR-709 Series measures stroke movements from 0.5 to 5.5 in., and has a rugged cast aluminum housing.

Magnetic devices and cylinders

Magnetostrictive position sensors were developed by MTS Sensors Div. of MTS Systems Corp. about 20 years ago. They were, and still are, known as the Temposonics line. Lately, MTS Sensors (Cary, NC) has collaborated with Paw-Taw-John Services of Rathdrum, Idaho to produce the Model 777ss Servo Sensor™ controller. The 777ss controller is a complete servo controller installed and interfaced inside a MTS® III sensor platform. It consists of a servo controller module, driver module, and sensing element combined inside the sensor head body. This integration provides the controller with fast displacement measurements and control outputs. Hydraulic cylinders typically can be positioned to 0.001 in. at 65 in. strokes. Resolution is 12 bits, and loop update time is 0.625 ms to 65.5 inches.

Another combination product is Parker

Hannifin's (Cylinder Div.) 2MA cylinder with built-in linear position sensor, which also uses magnetostrictive technology. The cylinder is available for hydraulic or pneumatic applications, and accurately senses a piston's position in relation to its stroke to the nearest one-thousandth of an inch. The 2MA cylinder/sensor is available in various mounting configurations and bore sizes from 2 to 8 inches. It has a resolution of $\leq 2 \mu\text{m}$, a hysteresis of $\leq 2 \mu\text{m}$, and operates in temperatures from -40 to $+85^\circ\text{C}$.

Thus far we've talked about measuring linear distance, but have you ever needed to measure distance on a curve? MTS Tempsonics (Cary, NC) has a new product looking for an application. It has just released its flexible sensors (Fig. 25) with Tempsonics III or L Series outputs including analog outputs, digital pulse outputs, and Profibus and DeviceNet bus outputs. Standard stroke lengths for the flexible IP65-rated sensor, which can be bent in an arc to an 8-in. radius, are up to 360 inches. Linearity is 0.02% fs, repeatability is 0.0001% of full stroke, and temperature range is from -40 to $+75^\circ\text{C}$.

Laser displacement/optical

If you need to measure distances precisely, laser displacement sensors will usually fit the bill. Laser-based sensors can be used for distance measurement, reference thickness, differential thickness and vibration measurement applications, as well as material deformation, alignment control and amplitude measurement in numerous industries. Other applications include positioning, oscillation measurement, surface control, and other specialized inspection applications.

One laser sensor you can use is LMI Selcom's (Detroit, MI) LDS (Laser Distance Sensor). The device (Fig. 26), which is based on laser triangulation principles, is capable of measurement rates up to 100 kHz. The LDS can resolve $0.1 \mu\text{m}$ when averaged at 9 Hz. It has a measurement range of 0.4 to 1.8 in., a standoff distance of 3.2 to 3.5 in., and an offset distance of 2.6 to 3.4 inches (depending on model). Accuracy is better than 0.5% at 10 kHz, and resolution is less than 0.1% of the measurement range.

Is it laser displacement or a line-scan camera? Actually, it's both. It was difficult to decide whether to put the following product

here or in the vision sensing section of this article. Acuity Research's (Menlo Park, CA) AR600™ series of line-scan camera laser displacement sensors consists of eleven models that have full scale spans from 0.125 in. with an accuracy of 4 microns up to a full scale span of 50 in. with an accuracy of 0.05 inch. The devices (Fig. 27) are suitable for use in measurement systems and applications from 0.5 to 80 in. and operate at up to 1250 samples/s. The AR600 sensors work on a triangulation principle—by projecting a focused laser spot onto the target surface and observing the spot position from an angle with a linear array camera. The devices are NEMA 4/IP67 rated for wet and dirty environments.

Need to measure velocity instead of distance? An option that can provide you with accurate laser-based velocity measurements is the S-100Z Laser Velocimetry Sensor from Canon USA's Semiconductor Div., Encoder Products (Melville, NY). The device (Fig. 28) measures a wide range of velocities of moving substrates from -12 m/minute to 120 m/minute. It has a detection precision of $\pm 0.2\%$ during pulse signal output and its $\pm 0.1\%$ optical measurement precision. Measurement resolution is available in 2.5, 5, 10, 20, 40, 80, 160, and 320 $\mu\text{m}/\text{pulse}$. The sensor works in temperatures from 0 to 45°C in 80% RH, and can be used for the measurement of reciprocating and intermittent motion for in-line systems. Applications include the measurement of fabric, paper, wood/lumber, wire and cable, steel, and other metals.

Optical devices

In the material that follows we'll look at optical sensors—from presence/absence to vision systems. According to Omron's Mike Frey, sensors product marketing manager, many sensors are being developed for specific applications (e.g., luster, color, label, and bottle).



FIG. 25: Tempsonics flexible sensors provide measurement on an arc up to a length of 360 inches.



FIG. 26: LMI Selcom's LDS has a measurement range from 0.4 to 1.8 in. and an accuracy of 0.5%.



FIG. 27: Acuity Research's AR600 laser displacement sensor is a line-scan device that measures widths from 1/8 in. to 50 inches (1/8 to 4 in. shown).



FIG. 28: Canon's S-100Z LDV sensor measures velocities of moving materials with $\pm 0.1\%$ precision.



FIG. 29: Sunx's IP67-rated EX20 photosensors have a 2 m range and work in ambient incandescent illumination of 3,000 lux.



FIG. 30: Eaton's TargetLock features a four-state LED indication proportional to the amount of sensing gain present.



FIG. 31: Square D's XUFN fiber optics sensor can be used in harsh chemical environments and in tight spaces.

Presence/absence

Presence/absence sensing has been one of the more important application areas for optical devices or photosensors. Small size and a relatively long range are two of the key characteristics of these types of sensors. One

good example of devices that score well on both counts is Sunx's (West Des Moines, IA) EX20 Series of sensors, which provide up to a 2 m sensing range. The front sensing models are 4.5 mm thick and side sensing models are 8.2 mm thick. The devices (Fig. 29) have NPN and PNP outputs, and are available in thru-beam, retroreflective, and diffuse reflective models.

Aromat (New Providence, NJ) has a similar sensor (PNP and NPN outputs) that saves space and has a 2 m range. Dubbed the UZB 5/6 series, it includes sensors, notes the vendor, that can be used as an alternative to fiber optic sensors, and has dimensions of 19 mm x 8.2 mm x 10.5 mm. The through-beam model has a range of 2 m, the retroreflective device a range of 200 mm, and the diffuse-reflective a range of 160 mm. Rated IP67, the devices come with a sensitivity control for fine adjustment, and the side sensing type has an operation mode switch to change the output operation.

"A sensor can have the greatest performance in the world, but if it is slightly misaligned, or the target is positioned at the wrong range, you will have reliability problems sooner or later," says Ron Gasser, Cutler-Hammer Sensors (Everett, WA). To get around this problem, Cutler-Hammer has added a microprocessor controlled system called

TargetLock™ in its SM Series (Fig. 30) to help users speed up the installation process, improve sensor reliability, and decrease unplanned downtime. This feature allows additional optimization of alignment or range between target and sensor above what is necessary for the sensor to operate. TargetLock fea-

tures a four-state LED indication proportional to the amount of sensing gain present. The TargetLock LED alerts users to any gain reduction, so maintenance can be performed before sensor failure. The SM Series 18 mm sensors include background suppression models, have 1.0 ms response time, and are available in thru-beam, polarized reflex, and diffuse reflective types.

If you have a close-range photosensing application, such as detecting small parts or precision alignment, take a look at the Telemecanique XUFN fiber optic sensors (Fig. 31) from Square D (Palatine, IL). The new additions to the XUD line, which are available in 10, 20, and 30 mm distances, are available in four versions: convergent beam lens, Teflon®-coated, power, and soft. The Teflon sensor resists harsh chemical environments and works in food and pharmaceutical applications. For applications where there is limited mounting space, the soft sensor can increase sensing distance over the standard version by up to 40%.

Balluff's (Florence, KY) BOS 20K fiber optic sensor features integral teach-in capability, which can help you cut down on setup time. The sensor (Fig. 32) has a 60 x 30 x 13 mm housing and works in parts detection, parts feature checks, counting, and part positioning applications. Sensitivity can be fine tuned with the +/- buttons. The sensor operates at 10-30 V dc, and is programmable for



FIG. 32: Balluff's BOS is CE rated and sealed to IP65. It is available with 2 m cable or four-pin M8 connector.

Image sensor helps automate wheel selection at GM facility

At the GM plant in Montreal, Quebec engineers wanted to be sure Firebirds were getting the correct wheels in initial assembly. There are some nine different wheel styles randomly assembled to order. With approximately forty-five cars per hour receiving wheels, automated verification was a necessity to maintain GM quality and throughput requirements. Proximity switches were employed originally, but the lack of flexibility in model changeovers and the difficulty to calibrate led the GM engineers to look for a better solution.

Charles Landry, an electrical engineer at the facility, discovered the DVT SmartImage Sensor and requested a demo from DVT's local automation solution provider, Rotalec. Impressed with the flexibility and ease of the Windows-based programming, Landry chose to use the system to identify various wheel styles by comparing their features.

Here's how the work cell functions

The build schedule is presented to the operator on a red LED marquee. The operator then loads four wheels and the spare is automatically inserted. The wheels are conveyed under the DVT sensor. A photocell triggers the inspection, while high frequency fluorescent lighting illuminates the wheel. The DVT system identifies the wheel model and communicates the model data to the PLC, which compares that information to the schedule. If the incorrect wheel is identified, the conveyor retains it and the operator receives a warning notification. "In a different department we used another vision system, but we did not touch it; it was too complicated. With the DVT system, we can do it ourselves and in our plant we tend to do things ourselves," explains Landry.

Inside the application

A Translational SoftSensor is used in FrameWork to find the edge of the wheel. Using that information a FindCenter SoftSensor locates the wheel's center. Then a series of FeatureCount tools provides the feedback necessary to create an if-then statement based on the results of each sensor. By using the system's digital I/O parameters, a pass/fail result is created for the entire group of SoftSensors, and the specific bit of data is sent to the PLC for comparison. "The FrameWork software is very user-friendly and flexible. I attended training in Atlanta and got a good base to start from," says Landry. Since its installation in June 1999, the system reportedly has performed very well.



PNP or NPN operation.

Omron has just released its E3Z (Fig. 33) line of photoelectric sensors, which features a long sensing distance (up to 15 m), high noise immunity, energy efficiency, and durability. The line of 16 sensors is available in through-beam, retroreflective and diffuse reflective models. The through-beam model senses to 15 m, the retroreflective to 4 m, and the diffuse-reflective model to 1 m. Suitable applications for this family include conveyors, food and beverage, and electronics. The IP67-rated sensors withstand temperatures from 5 to 70° C.

When you need a longer distance range and more precision, consider a laser-based through-beam sensor. Component Engineering's (Hewlett, NY) laser through-beam sensor can work at distances of up to 50 m and recognize objects as small as 0.05 mm. The visible through-beam arrangement offers simple focus adjustment and a reaction time of 100 μ s. The sensor, which is housed in a tough, hygienic stainless steel enclosure,

can be used to control overall height of an object, check for presence or absence in a hostile environment, remotely sense tool breaks, and detect breaks and tears in yarn or filaments in textile or wire winding machinery.

Color sensing and beyond

Photosensors have evolved into specialized types that are capable of color sensing, surface sensing, and some limited vision capabilities. There are several color photosensors on the market; one recently released device is Rockwell's ColorSight™ 9000 color recognition sensor (p. 22). The sensor detects the presence of a target based on a match with a learned reference color, with precision that is adjustable through an eight-position switch. It has self-teach and is built into a rugged enclosure that can withstand 1200 psi washdowns. Features



FIG. 33: Omron's new E3Z family can withstand wash-downs and works in noisy electrical environments.



FIG. 34: Banner's Presence-Plus can be programmed using the PRC1 handheld controller, which can show captured images.

include RGB detection, eight-color match precision settings, local and remote self-teach operation, and pulse stretcher for high-speed production. They have bipolar output and operate on 10-30 Vdc.

Another option is Omron's E3M-V color mark sensor with remote control adjustments. It has a 10 ± 3 mm sensing distance and a spot size of 1×4 mm. (For more info, See I&CS, March, 2000, p. 15.)

Vision systems: Easier to use



FIG. 35: Cognex's In-Sight 2000 is priced around \$5,000

Vision systems begin with the basics, such as Banner Engineering's PresencePlus™ pixel-counting sensor (Fig. 34). The complete system consists of a 512×384 CMOS pixel array with a programmable microprocessor, controller, lens, lighting, mounting bracket and cable, and lists

for under \$1700. Individual sensors list at \$995. The new sensor captures a 256-level grayscale image of a specified area, converts

the image to black and white pixels, and compares the designated color pixel count with user-programmed upper and lower threshold values to render a pass or fail judgment of the target.

If you're looking for small systems, give

some thought to Vision Components (Cambridge, MA) complete vision system, which has dimensions of $100 \times 50 \times 36$ mm and weighs 250 mg. Featuring a Sony $1/3$ -in. progressive scan sensor, the Model VC38 provides a pixel resolution of 640×480 pixels, an Analog Devices DSP, 8 Mbytes of SDRAM, and 2 Mbytes of nonvolatile flash EPROM. The system offers optically-isolated I/O (four 12-24 V inputs and four 150 mA

outputs), RS-232C port, pixel-identical sensor readout, and a VGA video output signal.

Getting vision systems small, relatively inexpensive, and easy to use has been a challenge for traditional vision system vendors, but more and more successes are being announced. For example, Cognex (Natick, MA) has just released its In-Sight™ 2000, an industrial machine vision sensor that is packaged in a small standalone box about the size of a Nintendo 64, and is priced around \$5,000. The device (Fig. 35) requires no programming or PC. The system offers a full library of Cognex's vision software tools including PatFind, a part location tool. The processor features an onboard DSP chip and a standard VGA output for an optional live display. The system includes controller, preinstalled software, digital cameras, and a handheld control pad that will be familiar to video gamers.

Have everything for your vision system but the camera? Need help finding a camera? National Instruments ((NI), Austin, TX) can help you find the camera you need for your NI hardware/software. National has created a Web site called *Camera Advisor*, <http://www.ni.com/camera>, which can help you choose from among more than 100 cameras (Fig. 36). This site will let the user compare different models and makes and types of cameras: line scan, area scan, progressive scan, digital and analog. It also compares technical details such as sensor size, pixel depth, frame rate, and pixel clock rate. Users input their application specs, and the Advisor will suggest appropriate and compatible cameras.

Sensors and more sensors

You can keep up to date on sensor technology by checking out I&CS's Sensor Update Section each and every month. In this section we bring you new product news, a rundown on the latest developments in sensing technologies, a look at what suppliers are doing, and application stories. Also, be sure to watch for the November issue of I&CS, which will feature a Special Report on flow, level, and pressure sensing and control. █

For more information...

The author, Wayne Labs, will be available to answer any questions you may have about this article. He can be reached at 610-325-8194 during normal business hours.



FIG. 36: National Instruments' Camera Advisor Web site lets users pick cameras for their NI vision system.



PRODUCT FEATURE

AutomationDirect releases micro-sized PLC, temperature/process controllers, timers

Wayne Labs

Senior Technical Editor

AutomationDirect has been busy expanding its product offerings. It recently added the Model DL06 micro PLC to its *Direct*LOGIC line of programmable controllers, and released three temperature and process controllers. It also announced a miniature DIN-rail timer and two types of $\frac{1}{16}$ timers, including a digital multimode timer.

Programmable controller features 36 to 100 I/O

The DL06 micro PLC (*center photo*) offers fixed models of 36 I/O points (starting at \$199), or up to 100 I/O points with expansion I/O. The PLC combines fixed I/O of 20 inputs and 16 outputs with four option card slots for expansion with discrete, analog, and communication modules. It is offered in a variety of I/O combinations and power supply options, including eight models of either ac or dc supplied units with combinations of ac, dc, and relay I/O.

Nine different discrete modules in 8, 10, and 16-point dc and relay versions are available, which start at \$42. In addition, four analog modules offer mA and voltage inputs and are priced from \$79.

The controller features 14.8 K total memory and 229 instructions, including 8 PID loops with built-in autotune capability. The device also offers two communication ports for programming and operator interface connectivity, as well as RS-232/422/485 networking, ASCII in/out, and Modbus RTU. Other features include integrated high-speed inputs and pulse outputs, and a built-in real-time clock/calendar.

For an additional \$59, an optional LCD operator interface is available. It snaps onto the front of the DL06 for OI functionality right at the PLC. The display features two rows by 16 characters, 14-point characters for easy readability, and seven function keys.

Automationdirect also has added new features to its

*Direct*SOFT32 programming software to accommodate the DL06. Priced at \$149, the software supports more than 220 instructions, such as floating point math, for/next loops, drum timer, subroutines, immediate I/O, and fill-in-the-blank ASCII instructions. The software has features to make troubleshooting easy, including compare contacts, bit-of-word addressing, and assignable nicknames. Programming can be done in ladder logic or RLL^{PLUS} Stage Programming.

Temperature/process controllers for DIN or panel mounting

Three temperature and process controllers (*left photo*) range from \$149 to \$229. Among them are a limit controller with two mechanical relays and universal inputs, including T/C, RTD, mA, mV and V; a temperature controller with two mechanical relays, one 4-20 mA output and T/C and RTD inputs; and a process controller with two mechanical relays or two solid state relays, one 4-20 mA output, and T/C, RTD, mA, mV, and V inputs. The temperature and process controllers also offer PID, autotune, and on/off control routines.

Miniature timers for rail and panel mounting

AutomationDirect has released a miniature DIN-rail timer and two types of $\frac{1}{16}$ timers, including a digital multimode timer (*right photo*). The timers feature DIN-rail or panel mounting and operating LEDs to check for proper operation. Four output modes can be selected for the multimode timers, including on-delay, flicker, one-shot, and off-delay. Timer outputs range from 2 A to 5 A with DPDT relays. Digital timers feature seconds to hours time ranges with decimal selection to meet a wide range of timing requirements. Prices run from \$35 to \$89.—AutomationDirect, 3505 Hutchinson Rd., Cumming, GA 30040, 800-633-0405, <http://www.automationdirect.com>.



(Left to right): AutomationDirect's temperature/process controllers, the DL06 micro PLC, and miniature DIN-rail and 1/16 timer families.

Image processing for QC

Compact with low power consumption, LABCam reduces costs without sacrificing image quality. Its one mega-pixel resolution, rapid data acquisition, and wide measurement range make this new digital camera suited to quantitative imaging measurements, including quality control in manufacturing industries. Its 10-bit per pixel sensor provides rapid acquisition while the USB 2.0 interface speeds data transfer rates to 480 Mbits/s. LABCam comes complete with camera control and data processing software.



—Société ELDIM, www.eldim.fr

Circle 110 on Control Solutions Int'l RS Card

Flowmeter talks and listens

The FlexMASter ST98 Series flowmeter now has two-way communications on the Profibus-DP protocol option. The flowmeter's advanced thermal mass sensing element is fully temperature compensated and delivers precision measurements over a wide flow range. It features an accuracy of $\pm 1\%$ of reading plus $\pm 0.5\%$ of full scale. Highly consistent, the ST98 has a repeatability of $\pm 0.5\%$ of reading. Its flow sensing element is comprised of two all-welded 316 stainless steel thermowells that protect RTDs.



—Fluid Components Intl., www.fluidcomponents.com

Circle 111 on Control Solutions Int'l RS Card

Low-level accelerometer

The Model 7290A Microtron® accelerometer measures low-level accelerations in aerospace and automotive applications. The accelerometer features hyperFLEX® coaxial cable assemblies that offer superior break strength and resistance to a wide variety of chemicals, solvents and liquids. The accelerometer operates from 9.5V to 18.0 V dc and provides a high-level, low impedance output. The +2 volt differential output is dc coupled at a dc bias of approximately 3.6 V. The device features an operating temperature range of -65°F to $+250^{\circ}\text{F}$ (-55°C to $+121^{\circ}\text{C}$).



—Endevco, www.endevco.com

Circle 113 on Control Solutions Int'l RS Card

{sensor update}

CSA-approved multigas monitor

The M40 Multi-Gas Monitor has been approved by the Canadian Standards Association, and also bears the UL mark for Class I, Groups A, B, C, and D; Class I, Zone 1, AEx ia d IIC T4 hazardous locations, and Cenelec (ATEX) approval with marking code EEx ia d IIC T4; Equipment Group and Category II 2G. Its standard features include a large display, continuous loop datalogger, peak/hold functions, STEL and TWA readings, Quick Cal calibration, and rechargeable lithium-ion battery for up to 18 hours of continuous runtime.



—Industrial Scientific, www.indsci.com

Circle 112 on Control Solutions Int'l RS Card

Benchtop digital thermometers

The MDSi8 and MDSSi8 Series thermometers are available in single and 10-channel versions, and feature totally programmable color displays, optional alarm relays or analog output. Universal Inputs include thermocouple, RTD, process voltage/current, strain on single channel models. Other features include high accuracy $\pm 0.5^{\circ}\text{C}$ ($\pm 0.9^{\circ}\text{F}$), 0.03% reading, optional embedded Internet, and portable, rugged metal benchtop enclosure with tilt handle.



—Omega Engineering,

http://www.omega.com/ppt/pptsc_lg.asp?ref=MDSi8_MDSSi8&Nav=teml04

Circle 114 on Control Solutions Int'l RS Card

Capacitive sensors have teach mode

The microprocessor-based TRIPLESIELD™ capacitive sensors now feature a single push-button Teach Mode that allows the user to program the sensing range and output, eliminating the need for a potentiometer. The sensors also have a remote-teach wire, allowing them to be fully programmed from a remote location. Sensing range has been increased to 12mm for the M18, and 30mm for the M30 style.



—Carlo Gavazzi Automation Components, www.GavazziOnline.com

Circle 115 on Control Solutions Int'l RS Card

Moisture analyzer handles low-pressure applications

The Model 3050-AM analyzers has been redesigned to allow operation at sample inlet pressures as low as 6 psig, making the it well suited for lower pressure applications, such as air separation and bulk liquid storage and distribution. The Model 3050-AM accurately measures from 0.1 p-p mV to 100 p-p mV and will provide measurements up to 1000 p-p mV. It features an intuitive easy-to-use operator interface with keypad and display that allows quick access to all operating variables.



—Ametek Process Instruments, www.ametekpi.com

Circle 116 on Control Solutions Int'l RS Card

Resolvers for motion/position control

The Harowe™ brand of resolvers offers a wide range of frameless resolvers—from size 10 to size 55. It also includes housed resolvers ranging from standard-grade size 11 to heavy-duty industrial-grade size 25. HaroMax frameless brushless resolvers feature tooth-wound construction. As a result of a more consistent winding, electrical error is 50 percent less than that of a standard resolver. Resolvers are available to withstand temperatures to 225°C and with radiation hardening.



—Danaher Industrial Controls Group, www.dancon.com

Circle 117 on Control Solutions Int'l RS Card

Sensor for color print control/inspection

This 640x480/752 x 582 print sensor can inspect complex and simple color print layouts at a rate up to 180 parts per minute. The print control sensor needs approximately 10 to 50 golden parts for teach-in. Additional fault processing can be carried out, and "allowable" faults can be suppressed in the course of optimization. Clear and easily understood parameters are provided for parameterization. Objects tested include bottle labels and caps, keyboards, laser markings on components, pad printing on PC boards, and more.



—Vision & Control GmbH, www.vision-control.com

Circle 118 on Control Solutions Int'l RS Card

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William E. Cariello, CBC
Publisher

February 18, 2004

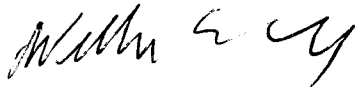
Dear Sir or Madam:

This letter serves as a reference for Wayne Labs, who worked for me on Control Solutions International magazine.

Wayne is one of the most knowledgeable, professional editors that I've encountered. Wayne's technical expertise crosses many boundaries, from network computing to industrial controls and factory automation. He possesses excellent editing skills, and is a strong writer and good interviewer. His monthly column for Control Solutions International magazine was well read and respected in the industry. Most importantly, Wayne is a team player, and easy to work with.

I would urge any company looking for someone with strong industrial communications skills to consider Wayne Labs.

Sincerely,



William E. Cariello
Publisher

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